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REMEDiate AND REHABILITATE  
SOUTH RIM SHOOTING RANGE  
GRAND CANYON NATIONAL PARK

# Calculations for

**Job:** Shooting Range

**Address:** Grand Canyon National Park, AZ

(These calculations apply to the job at this address only)

**Architect:** Nagaki Design Associates

## Index to Calculations:

**Sheet:**

**Item:**

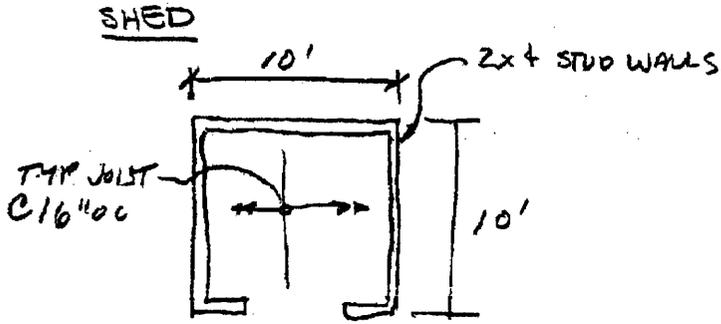
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DPA F+G  
Structural Engineers, Inc.

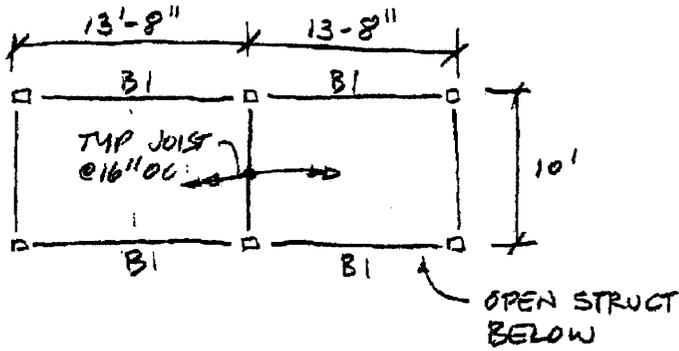
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original signature.

DATE 8/04	JOB NO. 204200	SHEET NO. OF 1
JOB: SHOOTING RANGE		
BY: JRH		
GFG Structural Engineers, Inc.		

KEY PLAN

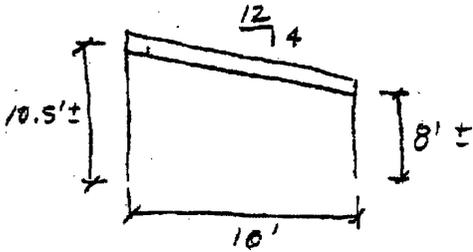


SHOOTING SHELTER



DATE 8/04	JOB NO. 204280	SHEET NO. OF 2
JOB: SHOOTING RANGE		
BY: JRH		
GFG Structural Engineers, Inc.		

ROOF FRAMING (SHED & SALTER)



DEAD LOAD:

- 1/2" PLYWD \_\_\_\_\_ 1.5
  - (2) LAYER OF 15# FELT \_\_\_\_\_ 4.0  
W/ ASPHALT SHINGLES
  - JOISTS @ 16" OC \_\_\_\_\_ 2.5
  - MISC \_\_\_\_\_ 1.0
- 9.0 PSF

LIVE \_\_\_\_\_ 20 PSF

GROUND SNOW = 5 PSF

ROOF SNOW =  $P_g C_e I$

$= 55(.9)(1.0) = 49.5 PSF$

USE 50 PSF

↑ ASSUME FORESTED SITE

↑ CONTROL

TYP JOIST @ 16" O.C.

$DL = 9 \left( \frac{12.65}{12} \right) \left( \frac{16}{12} \right) = 12.6$

USE = 13 PLF

$ST = 50 \left( \frac{16}{12} \right) = \frac{67}{80 PLF}$

$M = 80(10)^2/8 = 1000 \text{ #}$

$R = 80(5) = 400 \text{ #}$

D.F. NO 2.  $\left\{ \begin{aligned} F_b &= 875 (1.15) (1.15) (1.3) = 1504 \text{ PSI} \\ &\quad C_D \quad C_r \quad C_t \\ F_v &= 95 (1.15) = 109 \text{ PSI} \end{aligned} \right.$

TRY 2x8

$S_x = 13.14 \text{ in}^3$

$A = 10.89 \text{ in}^2$

$I = 47.63$

$f_b = 913 \text{ PSI} < F_b \checkmark$

$f_v = 55 \text{ PSI} < F_v \checkmark$

$\Delta_{TL} = .23" = 1/513 \checkmark$

USE 2x8 @ 16" OC

ROOF FRAMING

B1  
SHELTER

SPAN = 13'-0"

ROOF: DL = 9.5 (PSF) (S) = 47.5 PLF

CL = 50 (S) = 1250 PLF

FACIA: 10 PSF (3) = 30 PLF

$\Sigma$ DL = 77.5 PLF

$\Sigma$ CL = 250 PLF

DATE 8/04/2004	JOB NO. 204200	SHEET NO. OF 3
JOB: SHOOTING RANGE		
BY: JRIT		
GFG Structural Engineers, Inc.		

SEE PAGE 4  
FOR CALC

$\Sigma$ DL + CL = 50 PLF

GLR 3/8 x 2 10/12 (58) 4/343

4x12 .987 D=.37 1/447



**GFG**  
**Structural Engineers, Inc.**  
 6320 E. Thomas Rd., #100  
 Scottsdale, Az 85251

Title :  
 Dsgnr: JRH  
 Description :  
 Scope :

Job # 204280  
 Date: 1:01PM, 6 AUG 04

4

Rev: 510301  
 User: RW-0602046, Ver 6.1.3, 22-Jun-1999, Win32  
 (c) 1989-99 ENERCALC

**General Timber Beam**

c:\enercalc\204280 shooting range.scw:Calcula

Description B1

**General Information**

Calculations are designed to 1997 NDS and 1997 UBC Requirements

Section Name	3.125x12.0	Center Span	13.70 ft	.....Lu	0.00 ft
Beam Width	3.125 in	Left Cantilever	ft	.....Lu	0.00 ft
Beam Depth	12.000 in	Right Cantilever	ft	.....Lu	0.00 ft
Member Type	Glulam	Douglas Fir, 24F - V8			
Load Dur. Factor	1.150	Fb Base Allow	2,400.0 psi		
Beam End Fixity	Pin-Pin	Fv Allow	190.0 psi		
		Fc Allow	560.0 psi		
		E	1,800.0 ksi		

**Full Length Uniform Loads**

Center	DL	77.50 #/ft	LL	250.00 #/ft
Left Cantilever	DL	#/ft	LL	#/ft
Right Cantilever	DL	#/ft	LL	#/ft

**Summary**

Beam Design OK

Span= 13.70ft, Beam Width = 3.125in x Depth = 12.in, Ends are Pin-Pin

Max Stress Ratio	0.445 : 1	Maximum Shear * 1.5	3.4 k
Maximum Moment Allowable	7.7 k-ft	Allowable	8.2 k
Max. Positive Moment	7.68 k-ft at 6.850 ft	Shear:	@ Left 2.24 k
Max. Negative Moment	0.00 k-ft at 13.700 ft		@ Right 2.24 k
Max @ Left Support	0.00 k-ft	Camber:	@ Left 0.000 in
Max @ Right Support	0.00 k-ft		@ Center 0.114 in
Max. M allow	17.25		@ Right 0.000 in
fb 1,229.37 psi	fv 89.73 psi	Reactions...	
Fb 2,760.00 psi	Fv 218.50 psi	Left DL 0.53 k	Max 2.24 k
		Right DL 0.53 k	Max 2.24 k

**Deflections**

Center Span...	Dead Load	Total Load	Left Cantilever...	Dead Load	Total Load
Deflection	-0.076 in	-0.320 in	Deflection	0.000 in	0.000 in
...Location	6.850 ft	6.850 ft	...Length/Def	0.0	0.0
...Length/Def	2,167.9	513.01	Right Cantilever...		
			Deflection	0.000 in	0.000 in
			...Length/Def	0.0	0.0

**Stress Calcs**

<b>Bending Analysis</b>			Sxx	75.000 in3	Area	37.500 in2
Ck	20.711	Le	0.000 ft	0.000		
Cv	1.000	Rb	0.000			
		<b>Max Moment</b>	<b>Sxx Req'd</b>	<b>Allowable fb</b>		
@ Center		7.68 k-ft	33.41 in3	2,760.00 psi		
@ Left Support		0.00 k-ft	0.00 in3	2,760.00 psi		
@ Right Support		0.00 k-ft	0.00 in3	2,760.00 psi		
<b>Shear Analysis</b>			@ Left Support	@ Right Support		
Design Shear		3.37 k	3.37 k			
Area Required		15.401 in2	15.401 in2			
Fv: Allowable		218.50 psi	218.50 psi			
<b>Bearing @ Supports</b>			Bearing Length Req'd	1.282 in		
Max. Left Reaction		2.24 k	Bearing Length Req'd	1.282 in		
Max. Right Reaction		2.24 k				

**Query Values**

M, V, & D @ Specified Locations	Moment	Shear	Deflection	
@ Center Span Location =	0.00 ft	0.00 k-ft	2.24 k	0.0000 in
@ Right Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in
@ Left Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in

DATE 8/04	JOB NO. 204280	SHEET NO. OF 5
JOB: SHOOTING RANGE		
BY: JRH		
GFG Structural Engineers, Inc.		

TYPICAL STUD WALL

MAX HEIGHT = 10.5' ± e = 1"

SPACE STUDS AT 16" O.C.

$P_{DL} = 13 (10/2) = 65 \#$

$P_{ST} = 52 (10/2) = 260 \#$

↑ PER TYP 325 #  
JOIST  
CALC

WIND: 70 MPH, EXP C

$P = C_e C_q q_s I$

$C_e = 1.06$

$P = 16 \text{ PSF } (16/12) = 21.4 \text{ PLF}$

$C_q = 1.2$

$q_s = 12.6$

$I = 1.0$

APPLIED MOMENT =  $21.4 (10.5)^2 / 8 = 295 \text{ lbf}$   
DUE TO WIND:  $= 3540 \text{ lbf}$

D+S:  $P_D = 65 \#$   
 $P_S = 260 \#$   
WIND = — ← DOES NOT CONTROL BY INSPECTION

D+W+S/2:  $P_D = 65 \#$   
 $P_S = 130 \#$   
WIND = 3540 lbf

SEE PAGE FOR CALC

D+W/Z+S:  $P_D = 65 \#$   
 $P_S = 260 \#$   
WIND = 1770 lbf



**GFG**  
**Structural Engineers, Inc.**  
 6320 E. Thomas Rd., #100  
 Scottsdale, Az 85251

**Title :**  
**Dsgnr: JRH**  
**Description :**  
  
**Scope :**

**Job # 204280**  
**Date: 10:49AM, 6 AUG 04**

6

Rev: 510301  
 User: KW-0602046, Ver 5.1.3, 22-Jun-1999, Win32  
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**Timber Column Design**

c:\enercalc\204280 shooting range.ecw:Calcula

**Description** typical stud wall - D+W/2+S

**General Information** Calculations are designed to 1997 NDS and 1997 UBC Requirements

Wood Section	2x4	Total Column Height	10.50 ft	Le XX for Axial	10.50 ft
Rectangular Column		Load Duration Factor	1.33	Le YY for Axial	0.00 ft
Column Depth	3.50 in	Fc	1,350.00 psi	Lu XX for Bending	10.50 ft
Width	1.50 in	Fb	875.00 psi		
Sawn		E - Elastic Modulus	1,600 ksi		
		Douglas Fir - Larch, No.2			

**Loads**

	<u>Dead Load</u>	<u>Live Load</u>	<u>Short Term Load</u>
Axial Load	65.00 lbs	260.00 lbs	0.00 lbs
Eccentricity	1.000 in		
Applied Moment	0.00 in-#	0.00 in-#	1,770.00 in-#
Max. Design Moment	65.00 in-#	260.00 in-#	1,770.00 in-#

**Summary** Column OK

Using : 2x4, Width= 1.50in, Depth= 3.50in, Total Column Ht= 10.50ft

	<u>DL + LL</u>	<u>DL + LL + ST</u>	<u>DL + ST</u>
fc : Compression	61.90 psi	61.90 psi	12.38 psi
Fc : Allowable	350.00 psi	355.58 psi	355.58 psi
fbx : Flexural	106.12 psi	684.08 psi	599.18 psi
F'bx : Allowable	1,264.10 psi	1,640.11 psi	1,640.11 psi
Interaction Value	0.1321	0.5311	0.3792

**Stress Details**

Fc : X-X	350.00 psi	<b>For Bending Stress Calcs...</b>	
Fc : Y-Y	1,552.50 psi	Max k*Lu / d	50.00
Fc : Allowable	350.00 psi	Actual k*Lu/d	20.03
Fc:Allow * Load Dur Factor	355.58 psi	Min. Allow k*Lu / d	11.00
F'bx	1,264.10 psi	Cf:Bending	1.500
F'bx * Load Duration Factor	1,640.11 psi	Rb : (Le d / b^2) ^1.5	18.991
		<b>For Axial Stress Calcs...</b>	
		Cf : Axial	1.150
		Axial X-X k Lu / d	36.00
		Axial Y-Y k Lu / d	0.00



GFG  
Structural Engineers, Inc.  
8320 E. Thomas Rd., #100  
Scottsdale, Az 85251

Title :  
Dagnr: JRH  
Description :  
Scope :

Job # 204280  
Date: 10:49AM, 6 AUG 04

7

Rev: 510301  
User: KW-0602044, Ver 5.1.1.3, 22-Jun-1999, Win32  
(c) 1983-99 ENGERCALC

### Timber Column Design

c:\engercalc\204280 shooting\_range.ecw:Calcula

Description typical stud wall - D+W+S/2

#### General information

Calculations are designed to 1997 NDS and 1997 UBC Requirements

Wood Section	2x4	Total Column Height	10.50 ft	Le XX for Axial	10.50 ft
Rectangular Column		Load Duration Factor	1.33	Le YY for Axial	0.00 ft
Column Depth	3.50 in	Fc	1,350.00 psi	Lu XX for Bending	10.50 ft
Width	1.50 in	Fb	875.00 psi		
Sawn		E - Elastic Modulus	1,600 ksi		
		Douglas Fir - Larch, No.2			

#### Loads

	Dead Load	Live Load	Short Term Load
Axial Load	65.00 lbs	130.00 lbs	0.00 lbs
Eccentricity	1.000 in		
Applied Moment	0.00 in-#	0.00 in-#	3,540.00 in-#
Max. Design Moment	65.00 in-#	130.00 in-#	3,540.00 in-#

#### Summary

Column OK

Using : 2x4, Width= 1.50in, Depth= 3.50in, Total Column Ht= 10.50ft

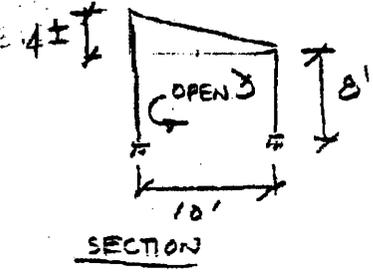
	DL + LL	DL + LL + ST	DL + ST
fc : Compression	37.14 psi	37.14 psi	12.38 psi
Fc : Allowable	350.00 psi	355.58 psi	355.58 psi
f <sub>bx</sub> : Flexural	63.67 psi	1,219.59 psi	1,177.14 psi
F <sub>bx</sub> : Allowable	1,264.10 psi	1,640.11 psi	1,640.11 psi
Interaction Value	0.0672	0.8374	0.7438

#### Stress Details

Fc : X-X	350.00 psi	For Bending Stress Calcs...	
Fc : Y-Y	1,552.50 psi	Max k*Lu / d	50.00
Fc : Allowable	350.00 psi	Actual k*Lu/d	20.03
F <sub>c</sub> :Allow * Load Dur Factor	355.58 psi	Min. Allow k*Lu / d	11.00
F <sub>bx</sub>	1,264.10 psi	Cf:Bending	1.500
F <sub>bx</sub> * Load Duration Factor	1,640.11 psi	Rb : (Le d / b <sup>2</sup> ) <sup>1.5</sup>	18.991
		For Axial Stress Calcs...	
		Cf : Axial	1.150
		Axial X-X k Lu / d	36.00
		Axial Y-Y k Lu / d	0.00

DATE 8/04	JOB NO. 204280	SHEET NO. OF 8
JOB: SHOOTING RANGE		
BY: JRH		
GFG Structural Engineers, Inc.		

LATERAL SHELTER

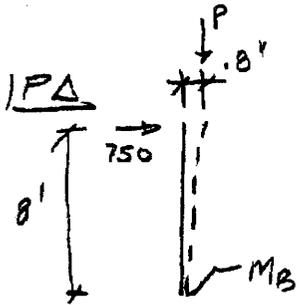
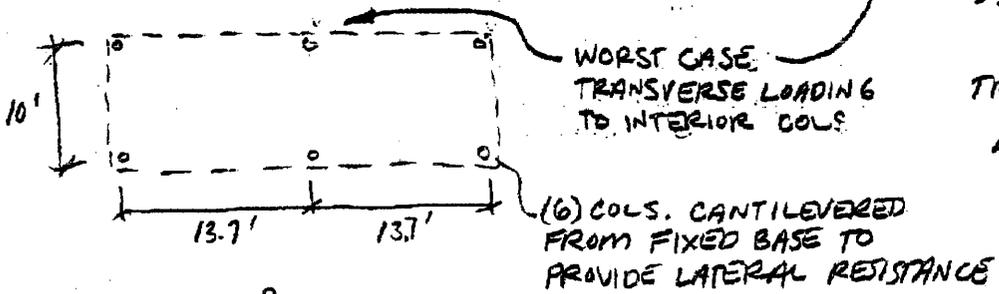


WIND LOAD BASED ON '91 UBC; 70 MPH EXP C.  
 CODE FOR THIS SITE IS 2000 IBC,  
 WIND IS EXPOSURE C 90 MPH (3 SEC GUST)  
 W/ AN IMPORTANCE FACTOR OF .87  
 $P = 18.2(.9)(1.0)(.87) = 14.3 \text{ PSF}$   
 ∴ DESIGN OKAY

TRUB HT = 4'  
 WIND CONTROLS BY INSPECTION  
 $W = 12.6(1.06)(1.3) = 17.4$   
 USE 20 PSF

$F = 20(4)(13.7) = 1100 \#$   
 LOAD SHARED BY (2) COLS  
 - SAY 750 # LOAD TO A SINGLE COL

TRY TS 4x4x5/16 COL  
 $\Delta = \frac{PL^3}{3EI} = \frac{750(8)^3(1728)}{3(29 \times 10^6)(9.58)} = .8''$   
 1/241 ✓



$P = 4.5^k - D + \text{SNOW}$   
 $P_D = 4.5(8) = 3590 \#$   
 $M_B = 750(8 \times 12) + 3590 = 75590 \#$   
 $= 62991 \#$

TS 4x4x5/16  
 $S_x = 4.79 \text{ in}^3$       $f_b = 15.8 \text{ ksi}$   
 $A = 4.36 \text{ in}^2$       $f_a = 1.03 \text{ ksi}$   
 $r = 1.48 \text{ in}$       $F_b = 27.6 \text{ ksi}$   
 $\frac{kl}{r} = \frac{2(8)}{r} = 130$       $F_c = 8.84 \text{ ksi}$

UPLIFT

$UP = 12.6(1.2)(1.0)(1.06) = 16 \text{ PSF}$   
 DEAD LOAD = 9 PSF  
 NET UPLIFT = 16 - 9 = 7 PSF  
 $P_{up} = 7(13.7)(5) = 480 \#$

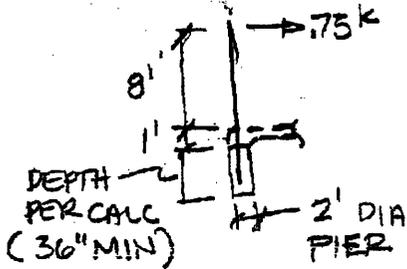
$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 1.69 \checkmark$      USE TS 4x4x5/16

COLUMN OKAY FOR UPLIFT BY INSPECTION

DATE 8/04	JOB NO. 204250	SHEET NO. OF 9
JOB: SHOOTING RANGE		
BY: JRT		
GFG Structural Engineers, Inc.		

FOUNDATIONS

SHELTER



SOIL PROPERTIES

NO SOILS REPORT AVAILABLE  
 ∴ USE CODE MINIMUMS  
 ASSUMING SAND, SILTY SAND, CLAYEY SAND  
 ALLOWABLE BRG = 1500 PSF ETC  
 PASSIVE = 150 PSF/FT  
 $\mu = .25$

SEE NEXT PAGE  
 FOR CALCULATION



GFG Structural Engineers, Inc.  
 6320 E. Thomas Road, Suite 100  
 Scottsdale, Arizona 85251  
 ph: 480-941-2367  
 fax: 480-941-0648

Title :  
 Dsgn:  
 Description :  
 Scope :

Job # 10  
 Date: 12:40PM, 5 AUG 04

Rev: 510302  
 User: KW-0602046, Ver 5.1.3, 22-Jun-1999, Win32  
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**Pole Embedment in Soil**

Page 1

Description cantilevered column

**General Information**

Allow Passive	250.00 pcf	Applied Loads...	
Max Passive	1,500.00 psf	Point Load	750.00 lbs
Load duration factor	1.330	distance from base	8.000 ft
Pole is Circular		Distributed Load	0.00 #/ft
Diameter	24.000 in	distance to top	3.000 ft
No Surface Restraint		distance to bottom	0.000 ft

**Summary**

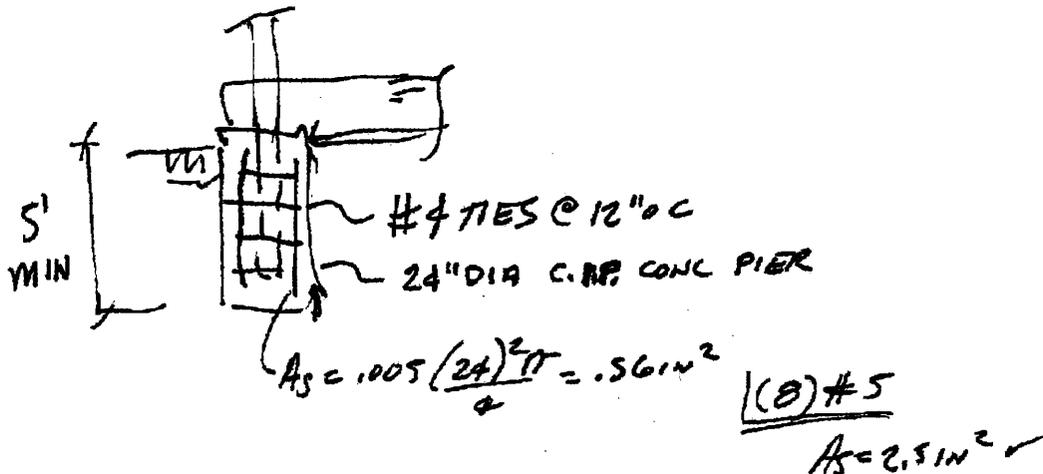
**Moments @ Surface...**

Point load	6,000.00 ft-#	Total Moment	6,000.00 ft-#
Distributed load	0.00	Total Lateral	750.00 lbs

**Without Surface Restraint...**

Required Depth	4.736 ft
Press @ 1/3 Embed...	
Actual	526.46 psf
Allowable	524.89 psf

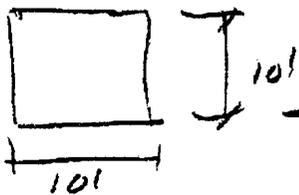
~ 5' EMBEDMENT



DATE 8/04	JOB NO. 204280	SHEET NO. OF 11
JOB: SHOOTING RANGE		
BY: JRH		
GFG Structural Engineers, Inc.		

LATERAL  
SHED

WIND = 14.3 PSF



$V = 80(5) = 400\#$

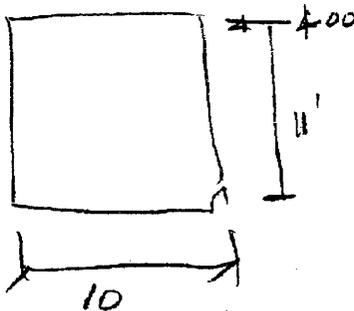
$V = \frac{400}{10} = 40 \text{ PLF}$

1/2" PLYWOOD  
UNBLOCKED  
8d NAILS @  
6" / 6" / 12"  
CMP = 180 PLF



$P = 14.3(5.5) = 78.6 \Rightarrow 80 \text{ PLF}$

SHEAR WALLS



$M_{OT} = 400(11) = 4,400 \text{ K}$

NON BEARING WALL

DEAD: PLYWOOD EA. SIDE = 3 PSF  
2x4 @ 16" OC = 1.5 PSF  
MSC = .5

$5 \text{ PSF} \times 10(11) = 550\#$

ROOF = 9 PSF (7)(10) = 63\#

613\#

TRANSVERSE WALL: ASSUME 3' RETURN

$WT = 3(5)(11) + 9(5)(3) = 300\#$

$M_{RE} = 613(10/2) + 300(10) = 6,070 \text{ K}$

FS = 1.4

TYPICAL A.B. WILL PROVIDED  
HOLD DOWN RESISTANCE THAT  
HAS NOT BEEN ACCOUNTED  
FOR.  $\therefore$  OKAY FOR STABILITY

-SOIL BEARING OKAY BY INSPECTION

BEARING WALL OKAY  
FOR STABILITY AND  
SOIL BEARING BY  
INSPECTION.

## SECTION 02070 - SELECTIVE DEMOLITION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:

- 1. Demolition and removal of selected site elements.
- 2. Patching and repairs.

- B. Related Sections: The following Sections contain requirements that relate to this Section:

- 1. Division 1 Section "Summary of Work" for use of the building and phasing requirements.
- 2. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.
- 3. Division 1 Section "Schedules and Reports" for selective demolition schedule requirements.
- 4. Division 1 Section "Construction Facilities and Temporary Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures for selective demolition operations.
- 5. Division 1 Section "Contract Closeout" for record document requirements.
- 6. Division 2 Section "Building Demolition" for demolition of buildings, structures, and site improvements.
- 7. Division 2 Section "Selective Demolition for Interiors" for partial demolition of the interior of a building undergoing alterations and for the removal, salvage, or reuse of materials in new construction.
- 8. Division 2 Section "Tree Protection and Trimming" for protecting trees remaining on-site.
- 9. Division 2 Section "Site Clearing" for site clearing and removing above- and below-grade improvements.
- 10. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.
- 11. Division 6 Section "Rough Carpentry" for material and construction requirements for temporary enclosures.
- 12. Division 9 Section "Gypsum Board Assemblies" for material and construction requirements for temporary enclosures.
- 13. Division 15 Sections for cutting, patching, or relocating mechanical items.
- 14. Division 16 Sections for cutting, patching, or relocating electrical items.

#### 1.3 DEFINITIONS

- A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.
- B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.

- C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
- D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

#### 1.4 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.
- B. Historical items indicated remain the Owner's property. Carefully remove and salvage each item in a manner to prevent damage and deliver promptly to the Owner.
- C. Historical items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner, which may be encountered during selective demolition, remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.
  - 1. Cooperate with Owner's archaeologist or historical adviser.

#### 1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.
- B. Proposed dust-control measures.
- C. Proposed noise-control measures.
- D. Schedule of selective demolition activities indicating the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
  - 2. Interruption of utility services.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
  - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
  - 6. Locations of temporary partitions and means of egress.
- E. Inventory of items to be removed and salvaged.
- F. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.
- G. Record drawings at Project closeout according to Division 1 Section "Contract Closeout."

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

- H. Landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

#### 1.6 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed selective demolition Work similar to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Predemolition Conference: Conduct conference at Project site to comply with preinstallation conference requirements of Division 1 Section "Project Meetings."

#### 1.7 PROJECT CONDITIONS

- A. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
  1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Storage or sale of removed items or materials on-site will not be permitted.

#### 1.8 SCHEDULING

- A. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

#### 1.9 WARRANTY

- A. Existing Special Warranty: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

### PART 2 - PRODUCTS (Not Applicable)

#### 2.1 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
  1. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  2. Use materials whose installed performance equals or surpasses that of existing materials.

### PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Owner.
- E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

### 3.2 UTILITY SERVICES

- A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.
    - a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.
- B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.
  - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.
  - 2. Arrange to shut off indicated utilities with utility companies.
  - 3. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
  - 4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.
- C. Utility Requirements: Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

### 3.3 PREPARATION

- A. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- B. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.
1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
  2. Protect existing site improvements, appurtenances, and landscaping to remain.
  3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
  4. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.
  5. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.

### 3.4 POLLUTION CONTROLS

- A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

### 3.5 SELECTIVE DEMOLITION

- A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:
1. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
  2. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.
- B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.
- C. Break up and remove concrete slabs on grade, unless otherwise shown to remain.

### 3.6 PATCHING AND REPAIRS

- A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.
- B. Patching is specified in Division 1 Section "Cutting and Patching."
- C. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
  - 1. Completely fill holes and depressions in existing masonry walls to remain with an approved masonry patching material, applied according to manufacturer's printed recommendations.
- D. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

### 3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials and dispose of at designated spoil areas on Owner's property.
- D. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### 3.9 SELECTIVE DEMOLITION SCHEDULE

- A. Remove the following:
  - 1. Existing A.C. Pavement

END OF SECTION 02070

## SECTION 02230 - SITE CLEARING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:

1. Protecting existing trees and vegetation to remain.
2. Removing trees and other vegetation.
3. Clearing and grubbing.
4. Topsoil stripping.
5. Removing above-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place.
7. Disconnecting, capping or sealing, and removing site utilities.

- B. Related Sections include the following:

1. Division 1 Section "Field Engineering" for verifying utility locations and for recording field measurements.
2. Division 1 Section "Construction Facilities and Temporary Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures during site operations.
3. Division 2 Section "Building Demolition" for demolition of buildings, structures, and site improvements.
4. Division 2 Section "Selective Demolition" for partial demolition of buildings or structures undergoing alterations.
5. Division 2 Section "Tree Protection and Trimming" for protecting trees remaining on-site that are affected by site operations.
6. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.
7. Division 2 Section "Landscaping" for finish grading, including placing and preparing topsoil for lawns and planting.

#### 1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

#### 1.4 MATERIALS OWNERSHIP

- A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

## 1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings according to Division 1 Section "Contract Closeout."
  - 1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

## 1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

## 1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing indicated removal and alteration work on property adjoining Owner's property will be obtained by Owner before award of Contract.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Notify utility locator service for area where Project is located before site clearing.

## PART 2 - PRODUCTS (Not Applicable)

### 2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."
  - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Locate and clearly flag trees and vegetation to remain or to be relocated.
- D. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

### 3.2 TREE PROTECTION

- A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
  - 1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
  - 2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
- B. Do not excavate within drip line of trees, unless otherwise indicated.
- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
  - 1. Cover exposed roots with burlap and water regularly.
  - 2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
  - 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
  - 4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by the appropriate authorities of Grand Canyon National Park.
  - 1. Employ a qualified arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
  - 2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

### 3.3 UTILITIES

- A. Contractor will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing.
  - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
  - 1. Contractor will arrange to shut off indicated utilities.

2. Arrange to shut off indicated utilities with utility companies.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  1. Notify Owner not less than two days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without Owner's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.
- E. Removal of underground utilities is included in Division 15 mechanical or Division 16 electrical Sections.

### 3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
  1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
  3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
  4. Use only hand methods for grubbing within drip line of remaining trees.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
  1. Place fill material in horizontal layers not exceeding 8-inch loose depth, and compact each layer to a density equal to adjacent original ground.

### 3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
  1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  1. Limit height of topsoil stockpiles to 72 inches.
  2. Do not stockpile topsoil within drip line of remaining trees.
  3. Dispose of excess topsoil as specified for waste material disposal.
  4. Stockpile surplus topsoil and allow for respreading deeper topsoil.

3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
  - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 02230

## SECTION 02231 - TREE PROTECTION AND TRIMMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the protection and trimming of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction.
- B. Related Sections include the following:
  - 1. Division 1 Section "Summary of Work" for limits placed on Contractor's use of the site.
  - 2. Division 1 Section "Construction Facilities and Temporary Controls" for temporary tree protection.
  - 3. Division 2 Section "Site Clearing" for removal limits of trees, shrubs, and other plantings affected by new construction.
  - 4. Division 2 Section "Earthwork" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.
  - 5. Division 2 Section "Landscaping" for tree and shrub planting and transplanting, tree support systems, and soil materials.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Certification: From a qualified arborist that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- D. Maintenance Recommendations: From a qualified arborist for care and protection of trees affected by construction during and after completing the Work.

#### 1.4 QUALITY ASSURANCE

- A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site on a full-time basis during execution of the Work.
- B. Arborist Qualifications: An arborist certified by the International Society of Arboriculture or licensed in the jurisdiction where Project is located.

- C. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
  - 1. Before starting tree protection and trimming, meet with representatives of authorities having jurisdiction, Owner, Architect, consultants, and other concerned entities. Review tree protection and trimming procedures and responsibilities. Notify participants at least three working days before convening conference. Record discussions and agreements and furnish a copy to each participant.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.
- B. Topsoil: Fertile, friable, surface soil, containing natural loam and complying with ASTM D 5268. Provide topsoil that is free of stones larger than 1 inch in any dimension and free of other extraneous or toxic matter harmful to plant growth. Obtain topsoil only from well-drained sites where soil occurs in depth of 4 inches or more; do not obtain from bogs or marshes.
- C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.
- D. Chain Link Fence: Metallic-coated steel chain link fence fabric, 0.120-inch diameter wire size; 48 inches high, minimum; line posts, 1.9 inches in diameter; terminal and corner posts, 2-3/8 inches in diameter; top rail, 1-5/8 inches in diameter; bottom tension wire, 0.177 inch in diameter; with tie wires, hog ring ties, and other accessories for a complete fence system.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Temporary Fencing: Install temporary fencing located as indicated or outside the drip line of trees to protect remaining vegetation from construction damage.
  - 1. Install chain link fence according to ASTM F 567 and manufacturer's written instructions.
- B. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.
- C. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line; prevent soil compaction over root systems.
- D. Do not allow fires under or adjacent to remaining trees or other plants.

### 3.2 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Do not excavate within drip line of trees, unless otherwise indicated.
- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
  - 1. Relocate roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and relocate them without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately **3 inches** back from new construction.
  - 2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
- D. Where utility trenches are required within drip line of trees, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
  - 1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

### 3.3 REGRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond drip line of trees. Maintain existing grades within drip line of trees.
- B. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by qualified arborist, unless otherwise indicated.
  - 1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.
- C. Minor Fill: Where existing grade is **6 inches** or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.
- D. Moderate Fill: Where existing grade is more than **6 inches**, but less than **12 inches**, below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
  - 1. Carefully place drainage fill against tree trunk approximately **2 inches** above elevation of finish grade and extend not less than **18 inches** from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to **6 inches** below elevation of grade.
  - 2. Place filter fabric with edges overlapping **6 inches** minimum.
  - 3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

### 3.4 TREE PRUNING

- A. Prune remaining trees affected by temporary and new construction.

- B. Prune remaining trees to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by qualified arborist.
- C. Pruning Standards: Prune trees according to ANSI A300 as follows:
  - 1. Type of Pruning: Crown cleaning.
  - 2. Type of Pruning: Crown thinning.
  - 3. Type of Pruning: Crown raising.
  - 4. Type of Pruning: Crown reduction.
  - 5. Type of Pruning: Vista pruning.
  - 6. Type of Pruning: Crown restoration.
- D. Cut branches with sharp pruning instruments; do not break or chop.
- E. Chip branches removed from trees. Spread chips where indicated or as directed by Architect.
- F. Tree branches extending over the roadway, which hang within 12 feet of the profile grade or that restrict sight distance shall be cut off close the trunk or stem of tree in a neat and workmanlike manner. The contractor shall remove additional tree branches under the direction of appropriate authorities of Grand Canyon National Park, in such a manner that the tree will present a balanced appearance. Scars resulting from the removal of branches shall be treated with a heavy coat of an approved tree sealant.

### 3.5 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.
- B. Remove and replace dead and damaged trees that the qualified arborist determines to be incapable of restoring to a normal growth pattern.
  - 1. Provide new trees of the same size and species as those being replaced; plant and maintain as specified in Division 2 Section "Trees and Shrubs."
  - 2. Provide new trees of 6-inch caliper size and of a species selected by Architect when trees more than 6 inches in caliper size, measured 12 inches above grade, are required to be replaced.
- C. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augured soil and sand.

### 3.6 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.
- B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property.

END OF SECTION 02231

## SECTION 02260 - EXCAVATION SUPPORT AND PROTECTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes excavation support and protection systems.
- B. Related Sections include the following:
  - 1. Division 1 Section "Construction Facilities and Temporary Controls."
  - 2. Division 2 Section "Earthwork" for excavating and backfilling.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Design, provide, monitor, and maintain an anchored and braced excavation support and protection system capable of resisting soil and hydrostatic pressure and supporting sidewalls of excavations.
  - 1. Work includes removing excavation support and protection systems when no longer needed.
  - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 3. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

#### 1.4 SUBMITTALS

- A. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems. System design and calculations must be acceptable to authorities having jurisdiction.
  - 1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by excavation support and protection systems.

#### 1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing excavation support and protection systems similar to those required for this Project and with a record of successful in-service performance.
- B. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services for designing excavation support and protection systems that are similar to those indicated for this Project in material, design, and extent.
  - 1. **Engineering Responsibility:** Engage a qualified professional engineer to prepare or supervise the preparation of data for the excavation support and protection system including drawings and comprehensive engineering analysis that shows the system's compliance with specified requirements.

## 1.6 PROJECT CONDITIONS

- A. **Existing Utilities:** Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted in writing by the Owner and then only after arranging to provide temporary utility services according to requirements indicated.
- B. **Project Site Information:** A geotechnical report has been prepared for this Project and is available for information only. The report is not part of the Contract Documents. The opinions expressed in this report are those of the geotechnical engineer and represent interpretations of the subsoil conditions, tests, and results of analyses conducted by the geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.
  - 1. Make additional test borings and conduct other exploratory operations as necessary.
  - 2. The geotechnical report is included elsewhere in the Project Manual.
  - 3. The geotechnical report is referenced elsewhere in the Project Manual.
- C. **Survey adjacent structures and improvements, employing a qualified professional engineer or surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.**
  - 1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Materials need not be new but must be in serviceable condition.
- B. **Structural Steel:** ASTM A 36.
- C. **Steel Sheet Piling:** ASTM A 328 or ASTM A 572.
- D. **Wood Lagging:** Lumber, mixed hardwood, nominal rough thickness of 3 inches.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
  - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- C. Locate excavation support and protection systems clear of permanent construction and to permit forming and finishing of concrete surfaces.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

### 3.2 SOLDIER BEAMS AND LAGGING

- A. Install steel soldier piles before starting excavation. Space soldier piles at intervals indicated. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at centers indicated and secure to soldier piles.

### 3.3 SHEET PILING

- A. Install one-piece sheet piling and tightly interlock to form a continuous barrier. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

### 3.4 TIEBACKS

- A. Tiebacks: Drill for, install, tension, and grout tiebacks into position. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

### 3.5 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing before removing original brace.
  - 1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by Architect.
  - 2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
  - 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

### 3.6 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and damaging structures, pavements, facilities, and utilities.
  - 1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.
  - 2. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

END OF SECTION 02260

## SECTION 02300 - EARTHWORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches within building lines.
8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

- B. Related Sections include the following:

1. Division 1 Section "Unit Prices" for a schedule of unit prices.
2. Division 1 Section "Construction Facilities and Temporary Controls."
3. Division 2 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.
4. Division 2 Section "Dewatering" for lowering and disposing of ground water during construction.
5. Division 2 Section "Tree Protection and Trimming" for protecting and trimming trees to remain.
6. Division 2 Section "Excavation Support and Protection."
7. Division 2 Section "Foundation Drainage Systems" for drainage of footings, slabs-on-grade, and walls.
8. Division 2 Section "Landscaping" for finish grading, including placing and preparing topsoil for lawns and plantings.
9. Division 3 Section "Cast-in-Place Concrete" for granular course over vapor retarder.
10. Division 15 and 16 Sections for excavating and backfilling buried mechanical and electrical utilities and buried utility structures.

#### 1.3 UNIT PRICES

- A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following:

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

5. 6 inches beneath bottom of concrete slabs on grade.
6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

B. Unit prices for rock excavation include replacement with approved materials.

#### 1.4 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Layer placed between the subbase course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, short-tip-radius rock bucket; rated at not less than 120-hp flywheel power with bucket-curling force of not less than 25,000 lbf and stick-crowd force of not less than 18,700 lbf; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 45,000-lbf breakout force; measured according to SAE J-732.

I. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material 3/4 cu. yd. or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2 inches.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- K. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
- L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- M. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

## 1.5 SUBMITTALS

### A. Product Data: For the following:

1. Each type of plastic warning tape.
2. Drainage fabric.
3. Separation fabric.

### B. Samples: For the following:

1. 30-lb samples, sealed in airtight containers, of each proposed soil material from on-site or borrow sources.
2. 12-by-12-inch sample of drainage fabric.
3. 12-by-12-inch sample of separation fabric.

### C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.
3. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.

## 1.6 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Preexcavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

## 1.7 PROJECT CONDITIONS

### A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Backfill and Fill: Satisfactory soil materials.
- E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2- inch sieve and not more than 12 percent passing a No. 200 sieve.
- F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No. 8 sieve.
- J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

### 2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
  - 1. Red: Electric.
  - 2. Yellow: Gas, oil, steam, and dangerous materials.
  - 3. Orange: Telephone and other communications.
  - 4. Blue: Water systems.
  - 5. Green: Sewer systems.
- C. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
  - 1. Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.
  - 2. Tear Strength: 40 lbf (178 N); ASTM D 4533.
  - 3. Puncture Resistance: 50 lbf (222 N); ASTM D 4833.
  - 4. Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.
  - 5. Apparent Opening Size: No. 50 (0.3 mm); ASTM D 4751.
- D. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
  - 1. Grab Tensile Strength: 200 lbf (890 N); ASTM D 4632.
  - 2. Tear Strength: 75 lbf (333 N); ASTM D 4533.
  - 3. Puncture Resistance: 90 lbf (400 N); ASTM D 4833.
  - 4. Water Flow Rate: 4 gpm per sq. ft. (2.7 L/s per sq. m); ASTM D 4491.
  - 5. Apparent Opening Size: No. 30 (0.6 mm); ASTM D 4751.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

### 3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
  - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

### 3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.
- B. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
  - 1. Do not damage adjacent structures, property, or site improvements or weaken the bearing capacity of rock subgrade when using explosives.

### 3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
- B. Classified Excavation: Excavation to subgrade elevations classified as earth and rock. Rock excavation will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
  - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
    - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
  - 2. Rock excavation includes removal and disposal of rock.
    - a. Do not excavate rock until it has been classified and cross-sectioned by Architect.

### 3.5 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

### 3.6 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
  - 1. Clearance: 12 inches (300 mm) on each side of pipe or conduit.
  - 2. Clearance: As indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
  - 1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
  - 2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
  - 3. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.
  - 1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

### 3.7 APPROVAL OF SUBGRADE

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
  - 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect.

### 3.8 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect.
  - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

### 3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.10 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for record documents.
  - 3. Inspecting and testing underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring and bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

### 3.11 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- D. Place and compact initial backfill of subbase material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit.
  - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- E. Coordinate backfilling with utilities testing.
- F. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- G. Place and compact final backfill of satisfactory soil material to final subgrade.
- H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### 3.12 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.

### 3.13 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.14 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
- D. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 95 percent.
  - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.
  - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.

### 3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
  2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Lawn or Unpaved Areas: Plus or minus 1 inch.
  2. Walks: Plus or minus 1 inch.
  3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

### 3.16 SUBBASE AND BASE COURSES

- A. Install separation fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
- B. Under pavements and walks, place subbase course on separation fabric according to fabric manufacturer's written instructions and as follows:
- C. Under pavements and walks, place subbase course on prepared subgrade and as follows:
1. Place base course material over subbase.
  2. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
  3. Shape subbase and base to required crown elevations and cross-slope grades.
  4. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
  5. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.
- D. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

### 3.17 DRAINAGE COURSE

- A. Under slabs-on-grade, install drainage fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends. Place drainage course on drainage fabric and as follows:
- B. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:
1. Compact drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
  2. When compacted thickness of drainage course is 6 inches or less, place materials in a single layer.
  3. When compacted thickness of drainage course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

### 3.18 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
  - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length, but no fewer than two tests.
  - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

### 3.19 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Architect/Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

### 3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

- B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Owner.
  - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300

## **02311 SOIL CEMENT BASE COURSE**

### **311.1 DESCRIPTION:**

This item shall consist of a base course composed of a mixture of local soil, portland cement, and water compacted at optimum moisture content.

### **311.2 MATERIALS:**

Portland cement and water shall comply with Sections 725 and 225. The soil for the mixture shall consist of the material in the area to be paved. The material shall not contain more than 5 percent gravel or stone retained on a 3-inch sieve. It shall be demonstrated by laboratory tests that the plasticity and hardening characteristics of the soil will be adequately modified by the specified cement content.

### **311.3 EQUIPMENT:**

An ample number of machines, combination of machines and equipment shall be provided and used to produce the complete soil cement base course meeting the requirements for soil pulverization, cement distribution, water application, incorporation of materials, compaction, finishing, and for application of the curing material as provided in these specifications. Mixing shall be accomplished by means of multiple-pass soil-cement mixer, single-pass soil-cement mixer or central plant mixer. Water may be applied through the mixer or with the water trucks equipped with pressure sprays. Water trucks providing fine fog-type sprays shall be furnished for finishing and curing. Properly adjusted garden type nozzles on a pressure bar may be used to produce fog spray if approved by the Engineer. Cement spreader shall be a specially constructed device to distribute bulk cement uniformly at rate specified either in windrows or on the flat as determined by method of mixing.

### **311.4 CONSTRUCTION METHODS:**

Before undertaking construction of the soil cement base course, the area to be paved shall be brought to a compacted condition, true to line and grade as directed by the Engineer or as shown on the plans. During this process any unsuitable soil or material, including excess material retained on a 3 inch sieve, shall be removed and replaced with acceptable material. The compacted surface shall be at the proper elevation as specified, shown on the plans, or as directed by the Engineer, for the top of the soil cement base. At completion of this phase, the material and surface shall be approved by the Engineer before proceeding with the next step. The material shall be scarified, pulverized, mixed with water and cement, compacted and finished and cured in lengths permitting the full roadway width to be complete in not more than 4 hours from the time that cement is exposed to water. Such lengths will generally be not less than 600 feet or the length of one City block and preferably more. Where a gutter section exists the material shall be pulled back from the gutter face for the full depth of the course before processing.

#### **311.4.1 Pulverizing:**

Before application of cement, soil to be processed shall be scarified to depth of base. The material should be damp at time of scarifying to reduce the dust to a minimum and to aid in pulverization. If the soil contains clods, it shall be pulverized until not less than 80 percent, exclusive of gravel or stone, will pass a No. 4 sieve.

#### **311.4.2 Application of Cement:**

The quantity of cement shall be by weight as a percentage of the dry weight of the soil as determined by the laboratory and/or as directed by the Engineer and shall be applied uniformly on the soil in a manner satisfactory to the Engineer. The allowable deviation in uniformity shall not exceed 10 percent. The entire operation of spreading and mixing shall be conducted in such a manner as will result in a uniform soil cement and water mixture for the full design width and depth. The percentage of moisture in the soil, at the time of cement application, shall not exceed the quantity that will permit a uniform and intimate mixture of the soil and cement during mixing operations, and it shall not exceed the specified optimum moisture content for the soil cement mixture.

#### **311.4.3 Mixing:**

Mixing with addition of water as required shall be continued until the product is uniform in color and at optimum moisture content. Any mixture of soil and cement which has not been compacted and finished shall not remain undisturbed for more than 30 minutes but shall be agitated by remixing.

#### **311.4.4 Optimum Moisture:**

Optimum moisture requirements and field tests of moisture density shall be determined in accordance with AASHTO T-134, T-191, T-217, or ASTM D-558, D-2922, D-3017 on representative samples of soil cement mixture obtained from the area being processed. At time of laydown, the moisture content shall not be below optimum moisture, and shall be less than that quantity which will cause the base course to become unstable during the compaction and finishing process. Any area, which becomes so unstable shall be removed and replaced with new cement-stabilized material.

#### **311.4.5 Compaction:**

After mixing is complete, the mixture shall be carefully placed in a uniform loose depth, which will provide a surface true to grade and section when compacted. Unless otherwise directed by the Engineer, initial compaction shall be by means of a tamping, grid, or pneumatic roller. After the tamping roller has partially walked out, pneumatic rollers shall be used. Density of final product shall be not less than 95 percent as determined by AASHTO or ASTM as specified above.

#### **311.4.6 Finishing:**

As compaction nears completion, the surface of the base course shall be shaped to required lines, grades and cross-section. When required, the surface shall be lightly scarified with spike tooth harrows or other approved equipment to remove imprints left by equipment or to prevent slippage planes. During the finishing process the surface shall be kept moist by means of fog-type sprays. Surface finish and final compaction shall be completed in not more than 2 hours from time of lay down. The completed base course shall be true to line, grade, cross-section and shall not vary more than 1/2 inch in thickness and not more than 1 inch in surface tolerance when tested with a 10 foot straight edge. It shall be free of surface cleavage planes, cracks, or loose material. As a final operation, the surface shall be very lightly scalped with a motor grader, wet with a fog spray and rolled with a pneumatic roller as directed by the Engineer.

#### **311.4.7 Deficiency:**

When in the opinion of the Engineer there is reason to believe that a deficiency in thickness exists, cores will be taken in the same pattern as that defined in Section 321. If the base has been covered or it is there wise impractical to correct the deficiency, the corrective measures, listed in Table 310-1 for Type I or II deficiencies, shall be taken by the Contractor at no additional cost to the Contracting Agency.

#### **311.4.8 Curing:**

After completion of the final finishing process, the soil-cement shall be cured with a bituminous curing seal applied at the end of each construction day. This seal may be either an emulsion or cut-back asphalt applied at a minimum rate of 0.20 gal./sq. yd. The finished soil-cement shall be kept continuously moist until the bituminous cure seal is applied, using fog or gravity bar spray. The spray equipment shall be approved by the Engineer before construction is begun.

#### **311.4.9 Construction Joints:**

At the end of each day's work, a construction joint shall be made transverse to the centerline of the road by cutting back into the work to provide a full depth vertical joint. Except where specifically authorized by the Engineer, no other construction joints will be permitted. Where authorized, such joints shall be full depth vertical joints.

**311.4.10 Maintenance:**

The Contractor shall maintain the surface until it has been covered with the designated bituminous wearing course. In case it is necessary to replace any soil cement, it shall be for the full depth. No skin patches or soil cement will be permitted. Minor surface pits may be filled with compacted bituminous surfacing, if authorized by the Engineer. Immediately prior to the placing of the bituminous wearing course, the surface shall be broomed to removed all loosened material from the surface.

**311.5 MEASUREMENT:**

Measurement of soil cement will be the number of square yards constructed to the required depth, completed and accepted. Measurement of portland cement will be the number of tons of cement mixed with local soil.

## SECTION 02553 - HIGH DENSITY POLYETHYLENE PIPE & FITTINGS FOR STORM DRAIN & SANITARY SEWER

### **738.1 GENERAL:**

This specification covers the requirements of profile-reinforced and corrugated (Type S or Type D) high density polyethylene (HDPE) pipe manufactured per ASTM F-894, AASHTO M-252 or AASHTO M-294 for gravity flow, low pressure storm drain and sanitary sewer systems. When noted on the plans or in the special provisions, gravity flow, low pressure storm drains and sanitary sewers may be constructed using HDPE pipe. The HDPE pipe will be of the sizes 8-inch diameter through 120-inch diameter. For the purpose of this specification, low pressure is defined as the test pressures of 3.5 psi of air or 4 feet of water as specified in Section 615.10. All pipe joints shall conform to the controlled pressure test of 10.8 psi of air or 25 feet of water as stipulated in ASTM D-3212. The size and class of the HDPE pipe to be furnished shall be designed by the Engineer and shown on the plans or in the project specifications. At no time will the class designed be less than RSC-63 for profile pipe, or minimum equivalent Pipe Stiffness (PS) for corrugated pipe per the requirements of AASHTO M-252 or AASHTO M-294.

### **738.2 MATERIALS:**

#### **738.2.1 Base Material Composition:**

Profile pipe base material and fittings shall, in accordance with ASTM F-894, be made from a PE plastic compound meeting the requirements of Type III, Class C, Category 5, Grade P34 as defined in ASTM D-1248 and with established hydrostatic design basis (HDB) of not less than 1250 psi for water at 73.4 degrees F. as determined in accordance with Method ASTM D-2837. Materials meeting the requirements of cell classification PE 334433 C or higher cell classification, in accordance with ASTM D-3350 are also suitable. Corrugated pipe base material shall comply with the requirements of AASHTO M-252 (Type S) or AASHTO M-294 (Type S or D) and have a minimum cell classification PE 335420C.

#### **738.2.2 Other Pipe Materials:**

Materials other than those specified under Base Materials shall comply with ASTM F-894, AASHTO M-252 or AASHTO M-294.

#### **738.2.3 Gaskets:**

Rubber gaskets shall be manufactured from a natural rubber, synthetic elastomer or a blend of both and shall comply in all respects with the physical requirements in ASTM F-477.

#### **738.2.4 Water Stops:**

Water stops shall be manufactured from a natural or synthetic rubber and shall conform to the requirements of ASTM C-923. The water stop shall have expansion rings, a tension band, or a take-up device used for mechanically compressing the water stop against the pipe.

#### **738.2.5 Thermal Welding Material:**

The material used for thermally welding the pipe material shall be compatible with the base material.

#### **738.2.6 Lubricant:**

The lubricant used for assembly shall comply to manufacturer's recommendations and have no detrimental effect on the gasket or pipe.

### **738.3 JOINING SYSTEMS:**

#### **738.3.1 Gasket Type:**

Joints for the piping system and fittings shall consist of an integrally formed bell and spigot gasketed joint. The joint shall be designed so that when assembled, the elastomeric gasket located on the spigot is compressed radially on the pipe or fitting bell to form a water tight seal. The joint shall be designed so to prevent displacement of the gasket from the joint during assembly and when in service. The elastomeric gasket shall meet the provision of ASTM F-477. All pipe shall have a home mark on the spigot end to indicate proper penetration when the joint is made. The bell and spigot configurations for the fittings shall be compatible to those used for the pipe. Joints shall provide a seal against exfiltration and infiltration. All surfaces of the joint upon which the gasket may bear, shall be smooth and free of any imperfections, which would adversely affect sealability. The assembly of the gasketed joints shall be in accordance with the pipe manufacturer's recommendations.

#### **738.3.2 Thermal Weld Type:**

The pipe ends shall consist of an integrally formed bell and spigot, with or without the elastomeric centering gasket, which join together to form an interface between bell and spigot, such that it is suitable to seal by thermal weld using the extrusion welding process, in accordance with the manufacturer's recommended procedure.

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Thermal welded joints may be effected by welding from inside the pipe or outside, or both. The assembly of the welded joints shall be in accordance with the manufacturer's recommendations. Thermal welded joints shall be used only when specified on plans or in specifications.

### **738.4 FITTINGS:**

Fittings for HDPE profile wall or corrugated pipe may include tees, elbows, manhole adapter rings, plugs, caps, adapters and increasers. Fittings shall be joined by gasket type or thermal weld type joints in accordance with Subsection 738.3. A clamp gasket or approved method shall be provided at manhole entry or connection to reduce infiltration and exfiltration. Where precast manholes are used, entrance holes must be large enough to allow for proper grouting around the manhole gasket. A non-shrink grout shall be used for grouting.

### **738.5 CERTIFICATION:**

The manufacturer shall furnish an affidavit (certification) that all materials delivered shall comply with the requirements of ASTM F-894, AASHTO M-252 or AASHTO M-294.

### **738.6 DIMENSIONS AND TOLERANCES:**

Profile wall HDPE pipe dimensions shall comply with dimensions given in Table 1 of ASTM F-894. The "average or nominal inside diameter" of profile wall HDPE pipe shall not deviate from its normal pipe size by more than as specified in Table 1 of ASTM F-894. Corrugated HDPE pipe dimensions shall be "nominal inside diameter" dimensions and shall not deviate from its nominal pipe size by more than the minimum and maximum tolerances as described in AASHTO M-252 or AASHTO M-294, Section 7.2.3. Profile pipe shall have a Ring Stiffness Constant (RSC) or Pipe Stiffness (PS) as shown on the plans. The minimum RSC for profile HDPE pipe shall be RSC-63. The minimum PS for corrugated pipe shall be as shown in AASHTO M-252 (Section 7.5) or AASHTO M-294 (Section 7.4), and tested per ASTM D-2412. In no case shall the minimum PS be less than the equivalent PS value for RSC-63.

**738.7 CLASSIFICATIONS:**

HDPE profile-reinforced pipe products shall be made in four standard Ring Stiffness Constant (RSC) classifications, 40, 63, 100 and 160. These are referred to as RSC-40, RSC-63, RSC-100 and RSC-160. The RSC test shall be conducted in accordance with ASTM D-2412 with the exceptions listed in accordance with ASTM F-894. HDPE corrugated pipe (Type S or Type D) shall meet the minimum Pipe Stiffness (PS) requirements of AASHTO M-252 or AASHTO M-294. The PS test shall be conducted in accordance with ASTM D-2412 with the exceptions listed in accordance with AASHTO M-252 or AASHTO M-294.

**738.8 MARKINGS:**

Markings on pipe shall be per ASTM F-894, AASHTO M-252 or AASHTO M-294.

**738.9 CARE OF PIPE AND MATERIALS:**

Care of pipe materials shall comply with Subsection 736.5. HDPE profile reinforced RSC type pipe in shipping or storage shall not be stacked higher than three rows for pipes 21-inches in diameter or less, nor higher than two rows for pipes 24 to 36-inches in diameter inclusive. Pipe shall not be stacked, shipped, or stored with weight on the bells of the pipe. Corrugated HDPE pipe in shipping and storage shall be stacked per manufacturer's recommendation, but in no case higher than 5 rows for pipe 24-inches or less in diameter, or 3 rows for pipe greater than 24-inches in diameter. Pipe that is gouged, marred, or scratched forming a clear depression shall not be installed and shall be removed if damaged in the installation.



### **National Park Service Ranges**

#### **\*OUTDOOR RUBBER RANGE BACKSTOP SPECIFICATIONS\***

THE FOLLOWING SPECIFICATIONS ARE SPECIFIC TO THE NATIONAL PARK SERVICE (NPS) RANGES TO BE INSTALLED AT THE NORTH AND SOUTH RIM OF THE PARK. REFER TO CAD DRAWINGS FOR DETAILED DEMENSIONS FOR EACH RANGE BACKSTOP. MATERIALS TO BE USED AS BY SUPER TRAP, INC. (STI) ARE:

- Concrete**
- Ballistic Rubber Media**
- SACON®**
- Gel-Cor™**

### **Ballistic and Environmental Specifications**

#### **1. Concrete**

As previously specified.

#### **2. Ballistic Rubber Media (BRM)**

The range backstop shall be covered with approximately (2) two feet of Ballistic Rubber Media (BRM) to decelerate and stop all projectiles up to and including .460 rifle caliber and .50 cal BMG from the 25 yard line. This rubber shall be: OTR-SBR type, free of all steel, 99.9% free of fiber, and with an average size from 3/4 inch to 1 & 1/4 inch. The SBR shall be mixed with the proper amount of materials as listed in item #3 to meet the environmental requirements as listed below, thus making it a Gel-Cor™ application.

#### **3. Gel-Cor™**

The BRM shall contain Gel-Cor which is a "Class A" fire rating material. This product shall also contain material, i.e. polymers and non-hazardous materials capable of preventing the loss of lead into contacting liquids. These materials shall be of such composition that a mixture of powdered lead and dry material

containing 1% by weight of powdered lead. (one part by weight powdered (<200 mesh) pure lead to 99 parts powdered buffer) shall not leach lead in excess of 5ppm when tested using the U.S. Environmental Protection Agency Toxic Characteristics Leaching Procedure (EPA Method 1311). This application shall in essence neutralize lead contamination in the backstop as well as accept tracer rounds without incident.

#### 4. **SACON® – Shock absorbing Concrete**

The BRM shall be bordered by a two foot SACON wall at the top and both sides of the backstop area. SACON is a formulation of fiber-reinforced foamed-cellular concrete which shall effectively de-energize and capture all bullet material which may strike the SACON border. SACON is an alkaline non-corrosive environment and contains many of the same properties of Gel-Cor. SACON. Like Gel-Cor will immobilize lead to below EPA standards.

#### **GENERAL SPECIFICATIONS**

- The backstop shall capture bullets fired from all conventional shotguns, handguns, pistols and rifles up to and including a .460 Weatherby rifle caliber (8,000 ft. lbs. energy at muzzle) Backstop shall be able to accept up to .460 Weatherby without damage to any part of the backstop system. The backstop will allow the shooting of 50 BMG rounds only from the 25 yard line.
- The backstop shall absorb all fired ammunition projectiles, including acute angle strikes while preventing splash backs and ricochets.
- The backstop shall eliminate ricochets and prevent fired bullets from exiting the range.
- The backstop shall reduce and minimize bullet fragmentation, deviation, and disintegration. Captured bullets for the most part shall be contained whole within the system, reducing pulverized lead particles. \*Excluding high velocity lightweight jacketed bullets and rounds striking baffles, walls, floors, or other hard objects prior to entering the media.
- There shall be no cover of any sort on the backstop systems media or system in general. The lack of: covers, matting, tiles and sheets are to facilitate:
  - The attenuation of sound
  - Allow rounds to penetrate to their maximum depth in the media
  - Eliminate ricochets
  - Reduce range down time
  - Eliminate rounds from bouncing back at shooters, and
  - Substantially reduce future maintenance costs to the owner.

- The backstop shall provide for the utmost possible reduction of hazardous lead materials, thereby insuring for an environmentally clean range, one which insures the highest degree of safety possible for all range employees and shooters.
- SACON<sup>®</sup> and Gel-Cor<sup>™</sup> are approved and licensed to STI from the Army Corps of Engineers, Research and Development Center (ACE). ACE technology was developed to reduce lead contamination well below one (5) part per million (5ppm) based on the standard TCLP test.
- There shall be no substances which may be deemed hazardous by the Environmental Protection Agency in this backstop as provided by STI.

Borax (*Sodium Borate*) known to be highly toxic when mixed with lead **shall not** be included.

## SECTION 03300 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.
- B. Cast-in-place concrete includes the following:
  - 1. Foundations and footings.
  - 2. Slabs-on-grade.
  - 3. Foundation walls.

#### 1.3 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
  - 1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
  - 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
  - 3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
- B. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

### PART 2 - PRODUCTS

#### 2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
  - 1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- H. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.
  - 1. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

## 2.2 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
  - 1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.
- B. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.
  - 1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
  - 2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.
- C. Water: Potable.

## 2.3 PROPORTIONING AND DESIGNING MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- B. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:
  - 1. 3500 psi, 28-day compressive strength; water-cement ratio, 0.51 maximum (non-air-entrained), 0.40 maximum (air-entrained).
  - 3. 3000 psi, 28-day compressive strength; water-cement ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained).
  - 4. 2500 psi, 28-day compressive strength; water-cement ratio, 0.67 maximum (non-air-entrained), 0.54 maximum (air-entrained).
- D. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:
  - 1. Subjected to freezing and thawing: W/C 0.45.
- E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
  - 1. Ramps, slabs, and sloping surfaces: Not more than 3 inches.
  - 2. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.
  - 3. Other concrete: Not more than 4 inches.

## 2.4 CONCRETE MIXING

- A. Job-Site Mixing: Mix concrete materials in appropriate drum-type batch machine mixer. For mixers of 1 cu. yd. or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than 1 cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional 1 cu. yd..
- B. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.
  - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

### 3.2 FORMS

- A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:
  - 1. Provide Class A tolerances for concrete surfaces exposed to view.
  - 2. Provide Class C tolerances for other concrete surfaces.
- B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.
- D. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

### 3.3 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.
- D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

### 3.4 JOINTS

- A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.
- B. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.
- C. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."
- G. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch wide by one-fourth of slab depth or inserts 1/4 inch wide by one-fourth of slab depth, unless otherwise indicated.
  - 1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
  - 2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
  - 3. If joint pattern is not shown, provide joints not exceeding 15 ft. (4.5 m) in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
  - 4. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

### 3.5 PREPARING FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
- B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
  - 1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

### 3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
  - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
  - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.
- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
  - 1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
  - 2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
  - 3. Maintain reinforcing in proper position on chairs during concrete placement.
- F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- G. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
  - 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

### 3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.
  1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.
  1. Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
  2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.8 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E 1155. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.
1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155. Grind smooth any surface defects that would telegraph through applied floor covering system.
- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
- E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- F. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and where indicated.
1. After completing float finishing and before starting trowel finish, uniformly spread dampened nonslip aggregate at a rate of 25 lb per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as specified.
  2. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose nonslip aggregate.
- G. Colored Wear-Resistant Finish: Apply a colored wear-resistant finish to monolithic slab surface indicated.
1. Apply dry shake materials for the colored wear-resistant finish at a rate of 100 lb per 100 sq. ft., unless a greater amount is recommended by material manufacturer.

2. Cast a trial slab approximately 10 ft. square to determine actual application rate, color, and finish, as acceptable to Architect.
3. Immediately following the first floating operation, uniformly distribute with mechanical spreader approximately two-thirds of the required weight of the dry shake material over the concrete surface, and embed by power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material with overlapping applications to ensure uniform color, and embed by power floating.
4. After broadcasting and floating, apply a trowel finish as specified. Cure slab surface with a curing compound recommended by the dry shake material manufacturer. Apply the curing compound immediately after the final finishing.

### 3.9 MISCELLANEOUS CONCRETE ITEMS

- A. **Filling In:** Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.
- B. **Curbs:** Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. **Equipment Bases and Foundations:** Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- D. **Steel Pan Stairs:** Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and trowel-finish concrete surfaces.

### 3.10 CONCRETE CURING AND PROTECTION

- A. **General:** Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. **Curing Methods:** Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.
- D. Provide moisture curing by the following methods:
  1. Keep concrete surface continuously wet by covering with water.
  2. Use continuous water-fog spray.
  3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch lap over adjacent absorptive covers.
- E. Provide moisture-retaining cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

### 3.11 SHORES AND SUPPORTS

- A. General: Comply with ACI 347 for shoring and reshoring in multistory construction, and as specified.
- B. Extend shoring from ground to roof for structures four stories or less, unless otherwise permitted.
- C. Extend shoring at least three floors under floor or roof being placed for structures over four stories. Shore floor directly under floor or roof being placed, so that loads from construction above will transfer directly to these shores. Space shoring in stories below this level in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members where no reinforcing steel is provided. Extend shores beyond minimums to ensure proper distribution of loads throughout structure.
- D. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.
- E. Keep reshores in place a minimum of 15 days after placing upper tier, or longer, if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

### 3.12 REMOVING FORMS

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

### 3.13 REUSING FORMS

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

### 3.14 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.
- B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.
  - 1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
  - 2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
  - 1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
  - 1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the

reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
  3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
  4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- E. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- F. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.
- G. Repair methods not specified above may be used, subject to acceptance of Architect.

END OF SECTION 03300

## SECTION 05120 - STRUCTURAL STEEL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings.

#### 1.2 SUMMARY

- A. This Section includes structural steel and architecturally exposed structural steel.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 5 Section "Metal Fabrications" for loose steel bearing plates and miscellaneous steel framing.
  - 4. Division 9 Section "Special Coatings" for surface preparation and priming requirements.
  - 5. Division 9 Section "Painting" for surface preparation and priming requirements.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.
- B. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural steel connections.

#### 1.4 SUBMITTALS

- A. Product Data for each type of product specified.
- B. Shop Drawings detailing fabrication of structural steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
  - 3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
  - 4. Include Shop Drawings signed and sealed by a qualified professional engineer responsible for their preparation.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

- B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
- C. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
  - 2. AISC's "Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings."
  - 3. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
  - 4. [ASTM A 6 \(ASTM A 6M\)](#) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
  - 7. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
  - 8. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.
- E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
  - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

#### 1.7 SEQUENCING

- A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Structural Steel Shapes, Plates, and Bars: As follows:
  - 1. Carbon Steel: [ASTM A 36 \(ASTM A 36M\)](#).
  - 2. High-Strength, Low-Alloy Columbium-Vanadium Steel: [ASTM A 572 \(ASTM A 572M\)](#), Grade 50.

3. High-Strength, Low-Alloy Structural Steel: [ASTM A 588](#) ([ASTM A 588M](#)), Grade 50, corrosion resistant.
- B. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.
  - C. Hot-Formed Structural Steel Tubing: ASTM A 501.
  - D. Steel Pipe: ASTM A 53, Type E or S, Grade B.
    1. Weight Class: Standard.
    2. Weight Class: Extra strong.
    3. Weight Class: Double-extra strong.
    4. Finish: Black.
    5. Finish: Galvanized.
    6. Finish: Black, except where indicated to be galvanized.
  - E. Carbon-Steel Castings: [ASTM A 27](#), Grade 65-35 ([ASTM A 27M](#), Grade 450-240), medium-strength carbon steel.
  - F. High-Strength Steel Castings: [ASTM A 148](#), Grade 80-50 ([ASTM A 148M](#), Grade 550-345).
  - G. Shear Connectors: ASTM A 108, Grade 1015 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.
  - H. Anchor Rods, Bolts, Nuts, and Washers: As follows:
    1. Unheaded Rods: [ASTM A 36](#) ([ASTM A 36M](#)).
    2. Unheaded Rods: [ASTM A 572](#), Grade 50 ([ASTM A 572M](#), Grade 345).
    3. Unheaded Bolts: ASTM A 687, high strength.
    4. Headed Bolts: [ASTM A 307](#), Grade A ([ASTM F 568](#), Property Class 4.6); carbon-steel, hex-head bolts; and carbon-steel nuts.
    5. Headed Bolts: [ASTM A 325](#) ([ASTM A 325M](#)), Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
    6. Headed Bolts: [ASTM A 490](#) ([ASTM A 490M](#)), Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
    7. Washers: [ASTM A 36](#) ([ASTM A 36M](#)).
  - I. Nonhigh-Strength Bolts, Nuts, and Washers: [ASTM A 307](#), Grade A ([ASTM F 568](#), Property Class 4.6); carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers.
    1. Finish: Plain, uncoated.
    2. Finish: Hot-dip zinc-coating, ASTM A 153, Class C.
    3. Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.
  - J. High-Strength Bolts, Nuts, and Washers: [ASTM A 325](#) ([ASTM A 325M](#)), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
    1. Finish: Plain, uncoated.
    2. Finish: Hot-dip zinc-coating, ASTM A 153, Class C.
    3. Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.
    4. Direct-Tension Indicators: ASTM F 959, Type 325.
      - a. Finish: Plain, uncoated.
      - b. Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.
      - c. Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50, epoxy coated.

- K. High-Strength Bolts, Nuts, and Washers: [ASTM A 490](#) ([ASTM A 490M](#)), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.
  - 1. Direct-Tension Indicators: ASTM F 959, Type 490, uncoated.
- L. Welding Electrodes: Comply with AWS requirements.

## 2.2 PRIMER

- A. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.
- B. Primer: SSPC-Paint 25; red iron oxide, zinc oxide, raw linseed oil and alkyd primer.
- C. Primer: SSPC-Paint 23, latex primer.
- D. Primer: SSPC-Paint 15, Type I, red oxide.
- E. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
- F. Primer: Nonasphaltic primer complying with SSPC's "Painting System Guide No. 7.00."
- G. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

## 2.3 FABRICATION

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.
  - 1. Camber structural steel members where indicated.
  - 2. Identify high-strength structural steel according to [ASTM A 6](#) ([ASTM A 6M](#)) and maintain markings until steel has been erected.
  - 3. Mark and match-mark materials for field assembly.
  - 4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
  - 5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
  - 6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
- B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.
  - 1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
  - 2. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded.
- D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.
- E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.
- F. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.
1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
  2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

## 2.5 SHOP CONNECTIONS

- A. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
  2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds **1/2 inch (13 mm)** and larger. Grind flush butt welds. Dress exposed welds.

## 2.6 PREFABRICATED BUILDING COLUMNS

- A. Definition: Prefabricated building columns consist of assemblies composed of load-bearing structural steel members encased in manufacturer's standard insulating material for fire protection and wrapped in outer nonload-bearing steel sheet enclosures.
- B. Column Configuration: Provide columns of sizes and shapes indicated. Fabricate connections to comply with details shown or required to suit type of structure indicated.
1. Concrete Fill: Structural concrete, manufacturer's standard mix, with a minimum 28-day compressive strength of **5000 psi (34.5 MPa)**, machine mixed and mechanically vibrated during placement to produce a concrete core free of voids.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering prefabricated building columns that may be incorporated in the Work include, but are not limited to, the following:

## 2.7 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of **2 inches (50 mm)**.
  2. Surfaces to be field welded.
  3. Surfaces to be high-strength bolted with slip-critical connections.
  4. Surfaces to receive sprayed-on fireproofing.

- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:
  - 1. SSPC-SP 2 "Hand Tool Cleaning."
  - 2. SSPC-SP 3 "Power Tool Cleaning."
  - 3. SSPC-SP 5 "White Metal Blast Cleaning."
  - 4. SSPC-SP 6 "Commercial Blast Cleaning."
  - 5. SSPC-SP 7 "Brush-Off Blast Cleaning."
  - 6. SSPC-SP 8 "Pickling."
  - 7. SSPC-SP 10 "Near-White Blast Cleaning."
  - 8. SSPC-SP 11 "Power Tool Cleaning to Bare Metal."
  
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

## 2.8 SOURCE QUALITY CONTROL

- A. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
  
- B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
  
- C. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
  - 1. Liquid Penetrant Inspection: ASTM E 165.
  - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  - 3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
  - 4. Ultrasonic Inspection: ASTM E 164.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.
  
- B. Do not proceed with erection until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design

loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
- B. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
  1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- C. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  1. Level and plumb individual members of structure.
  2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- D. Splice members only where indicated.
- E. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- F. Do not use thermal cutting during erection.
- G. Finish sections thermally cut during erection equal to a sheared appearance.
- H. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

### 3.4 FIELD CONNECTIONS

- A. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.
- B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Install and tighten high-strength bolts according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
  1. Bolts: [ASTM A 325](#) ([ASTM A 325M](#)) high-strength bolts, unless otherwise indicated.
  2. Bolts: [ASTM A 490](#) ([ASTM A 490M](#)) high-strength bolts, unless otherwise indicated.
  3. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

4. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.
- D. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
  2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
  3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds **1/2 inch (13 mm)** and larger. Grind flush butt welds. Dress exposed welds.

### 3.5 PREFABRICATED BUILDING COLUMNS

- A. Install prefabricated building columns to comply with AISC specifications referenced in this Section, manufacturer's recommendations, and requirements of the testing and inspecting agency that apply to the fire-resistance rating indicated.

### 3.6 CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
1. Apply by brush or spray to provide a minimum dry film thickness of **1.5 mils (0.038 mm)**.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on structural steel are included in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

END OF SECTION 05120

## SECTION 06100 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Construction Documents.

#### 1.2 SUMMARY

- A. This Section includes the following:

1. Framing with dimension lumber.
2. Framing with timbers.
3. Sheathing.

- B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 5 Section "Structural Steel."

#### 1.3 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.
- B. Exposed Framing: Dimension lumber not concealed by other construction and indicated to receive a stained or natural finish.

#### 1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.
- C. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:
  1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Wood-Preservative-Treated Materials:
    - a. Baxter: J. H. Baxter Co.
    - b. Chemical Specialties, Inc.
    - c. Continental Wood Preservers, Inc.
    - d. Hickson Corp.
    - e. Hoover Treated Wood Products, Inc.
    - f. Osmose Wood Preserving, Inc.
  2. Laminated-Veneer Lumber:
    - a. Alpine Structures.
    - b. Boise Cascade Corp.
    - c. Georgia-Pacific Corp.
    - d. Louisiana-Pacific Corp.
    - e. Trus Joist MacMillan.
    - f. Willamette Industries, Inc.
  5. Metal Framing Anchors:
    - a. Cleveland Steel Specialty Co.
    - b. Harlen Metal Products, Inc.
    - c. Silver Metal Products, Inc.
    - d. Simpson Strong-Tie Company, Inc.
    - e. Southeastern Metals Manufacturing Co., Inc.

### 2.2 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
  1. NELMA - Northeastern Lumber Manufacturers Association.
  2. NLGA - National Lumber Grades Authority (Canadian).
  3. RIS - Redwood Inspection Service.
  4. SPIB - Southern Pine Inspection Bureau.
  5. WCLIB - West Coast Lumber Inspection Bureau.

6. WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
  1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps and provide grade-compliance certificates issued by inspection agency.
- D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  1. Provide dressed lumber, S4S, unless otherwise indicated.
  2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.
  3. Provide lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

### 2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
  1. Do not use chemicals containing chromium or arsenic.
  2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. (4.0 kg/cu. m). After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
  1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  3. Wood framing members less than 18 inches (460 mm) above grade.
  4. Wood floor plates installed over concrete slabs directly in contact with earth.
- C. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft. (6.4 kg/cu. m).
- D. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

### 2.4 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.
- B. Exterior and Load-Bearing Walls: Provide framing of the following grade and species:

D. Framing Other than Non-Load-Bearing Partitions: Provide framing of the following grade and species:

1. Grade: No. 2.
2. Grade: Construction or No. 2.
3. Grade: Construction, Stud, or No. 3.
4. Species: Spruce-pine-fir south; NELMA.
5. Species: Douglas fir-larch north; NLGA.
6. Species: Hem-fir north; NLGA.
7. Species: Spruce-pine-fir north; NLGA.
8. Species: Southern pine; SPIB.
9. Species: Mixed southern pine; SPIB.
10. Species: Douglas fir-larch; WCLIB or WWPA.
11. Species: Hem-fir; WCLIB or WWPA.
12. Species: Douglas fir south; WWPA.
13. Species: Any species above.
14. Species and Grade: Any species of machine stress-rated (MSR) dimension lumber with a grade of 1450f-1.3E.
15. Species and Grade: Any species of machine stress-rated (MSR) dimension lumber with a grade of 1800f-1.6E.

E. Other Framing Not Listed Above: Provide the following grades and species:

1. Grade: Select Structural.
2. Grade: No. 1.
3. Grade: No. 2.
4. Grade: Construction or No. 2.
5. Grade: Construction, Stud, or No. 3.
6. Species: Douglas fir-larch north; NLGA.
7. Species: Hem-fir north; NLGA.
8. Species: Southern pine; SPIB.
9. Species: Douglas fir-larch; WCLIB or WWPA.
10. Species: Hem-fir; WCLIB or WWPA.
11. Species: Douglas fir south; WWPA.
12. Species: Any species above.
13. Species and Grade: Any species of machine stress-rated (MSR) dimension lumber with a grade of 1450f-1.3E.
14. Species and Grade: Any species of machine stress-rated (MSR) dimension lumber with a grade of 1800f-1.6E.
15. Species and Grade: Any species and grade with a modulus of elasticity of at least 1,300,000 psi (8950 MPa) and an extreme fiber stress in bending of at least 850 psi (5.9 MPa) for 2-inch nominal (38 mm-actual) thickness and 12-inch nominal (286-mm actual) width for single member use.

G. Exposed Framing: Provide material hand-selected from lumber of species and grade indicated below for uniformity of appearance and freedom from characteristics that would impair finish appearance.

1. Species and Grade: As indicated above for load-bearing construction of same type.
2. Species and Grade: Spruce-pine-fir south, Select Structural; NELMA, WCLIB, or WWPA.
3. Species and Grade: Hem-fir north, Select Structural; NLGA.
4. Species and Grade: Spruce-pine-fir north, Select Structural; NLGA.
5. Species and Grade: Redwood, Clear Heart Structural; RIS.
6. Species and Grade: Redwood, Clear Structural; RIS.
7. Species and Grade: Southern pine, Select Structural; SPIB.
8. Species and Grade: Hem-fir, Select Structural; WCLIB or WWPA.

## 2.6

- A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

## 2.9 ENGINEERED WOOD PRODUCTS

- A. General: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that evidence compliance with building code in effect for Project.
  - 1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Laminated-Veneer Lumber: Lumber manufactured by laminating wood veneers in a continuous press using an exterior-type adhesive complying with ASTM D 2559 to produce members with grain of veneers parallel to their lengths and complying with the following requirements:
  - 1. Extreme Fiber Stress in Bending: 2500 psi (17 MPa) for 12-inch nominal- (286-mm actual-) depth members.
  - 2. Modulus of Elasticity: 2,000,000 psi (13 800 MPa).
  - 3. Tension Parallel to Grain: 1850 psi (13 MPa).
  - 4. Compression Parallel to Grain: 2800 psi (19 MPa).
  - 5. Compression Perpendicular to Grain: 400 psi (3 MPa) perpendicular to and 500 psi (3.5 MPa) and parallel to glue line.
  - 6. Horizontal Shear: 285 psi (2 MPa) perpendicular to and 190 psi (1.3 MPa) parallel to glue line.
- C. Parallel-Strand Lumber: Lumber manufactured by laying up wood strands using an exterior-type adhesive complying with ASTM D 2559, and cured under pressure to produce members with grain of strands parallel to their lengths and complying with the following requirements:
  - 1. Extreme Fiber Stress in Bending: 2900 psi (20 MPa) for 12-inch nominal- (286-mm actual-) depth members.
  - 2. Modulus of Elasticity: 2,000,000 psi (13 800 MPa).
  - 3. Tension Parallel to Grain: 2400 psi (16.5 MPa).
  - 4. Compression Parallel to Grain: 2900 psi (20 MPa).
  - 5. Compression Perpendicular to Grain: 400 psi (3 MPa) perpendicular to and 600 psi (4.1 MPa) and parallel to wide face of strands.
  - 6. Horizontal Shear: 210 psi (1.4 MPa) perpendicular to and 290 psi (2 MPa) and parallel to wide face of strands.

## 2.10 WOOD-BASED STRUCTURAL-USE PANELS, GENERAL

- A. Structural-Use Panel Standards: Provide either all-veneer, mat-formed, or composite panels complying with DOC PS 2, "Performance Standard for Wood-Based Structural-Use Panels," unless otherwise indicated. Provide plywood panels complying with DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood," where plywood is indicated.
- B. Structural-Use Panel Standard: Provide plywood panels complying with DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood."
- C. Trademark: Factory mark structural-use panels with APA trademark evidencing compliance with grade requirements.

## 2.11 CONCEALED, PERFORMANCE-RATED STRUCTURAL-USE PANELS

- A. General: Where structural-use panels are indicated for the following concealed types of applications, provide APA-performance-rated panels complying with requirements designated under each application for grade, span rating, exposure durability classification, and edge detail (where applicable).
  - 1. Thickness: Provide panels meeting requirements specified but not less than thickness indicated.
  - 2. Span Ratings: Provide panels with span ratings required to meet "Code Plus" provisions of APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial."
- B. Wall Sheathing: APA-rated sheathing.
- E. Wall Sheathing: APA-rated Structural I sheathing.
  - 1. Exposure Durability Classification: Exterior.
  - 2. Exposure Durability Classification: Exposure 1.
  - 3. Span Rating: As required to suit stud spacing indicated.
  - 4. Span Rating: 12/0, 16/0, 20/0, or Wall - 16 for stud spacing of 16 inches (406 mm) or less.
  - 5. Span Rating: 24/0, 24/16, 32/16, or Wall - 24 for stud spacing of 24 inches (610 mm) or less.
- F. Roof Sheathing: APA-rated sheathing.
- G. Roof Sheathing: APA-rated Structural I sheathing.
  - 1. Exposure Durability Classification: Exterior.
  - 2. Exposure Durability Classification: Exposure 1.
  - 3. Span Rating: As required to suit rafter spacing indicated.
  - 4. Span Rating: 12/0.
  - 5. Span Rating: 16/0 or Roof - 16.
  - 6. Span Rating: 20/0 or Roof - 20.
  - 7. Span Rating: 24/0 or Roof - 24.
  - 8. Span Rating: 24/16.
  - 9. Span Rating: 32/16 or Roof - 32.
  - 10. Span Rating: 40/20 or Roof - 40.
  - 11. Span Rating: 48/24 or Roof - 48.

## 2.12 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M)
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

## 2.20 METAL FRAMING ANCHORS

- A. General: Provide galvanized steel framing anchors of structural capacity, type, and size indicated and as follows:
  - 1. Research or Evaluation Reports: Provide products for which model code research or evaluation reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for Project.
  - 2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 (ASTM A 653M, Z180) coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.
- C. Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges at least 85 percent of joist depth.
  - 1. Thickness: 0.052 inch (1.3 mm).
  - 2. Thickness: 0.064 inch (1.6 mm).
- D. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
  - 1. Width: 3/4 inch (19 mm).
  - 2. Width: 1-1/4 inches (32 mm).
  - 3. Thickness: 0.052 inch (1.3 mm).
  - 4. Thickness: 0.064 inch (1.6 mm).
  - 5. Length: 16 inches (400 mm).
  - 6. Length: 24 inches (600 mm).
  - 7. Length: As indicated.
- H. Rafter Tie-Downs (Hurricane Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-5/8 inches (41 mm) wide by 0.052 inch (1.3 mm) thick.

- I. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of 2 bolts placed 7 bolt diameters from reinforced base.
  - 1. Bolt Diameter: 5/8 inch (16 mm).
  - 2. Bolt Diameter: 3/4 inch (19 mm).
  - 3. Width: 2-1/2 inches (64 mm).
  - 4. Width: 3-3/16 inches (81 mm).
  - 5. Body Thickness: 0.108 inch (2.8 mm).
  - 6. Body Thickness: 0.138 inch (3.5 mm).
  - 7. Base Reinforcement Thickness: 0.180 inch (4.6 mm).
  - 8. Base Reinforcement Thickness: 0.239 inch (6.1 mm).
- K. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches (29 mm) wide by 9/16 inch (14 mm) deep by 0.034 inch (0.85 mm) thick with hemmed edges.
- L. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch (24 by 24 by 1 mm) thick with hemmed edges.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Apply field treatment complying with AWWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.
  - 2. Published requirements of metal framing anchor manufacturer.
  - 3. "Recommended Nailing Schedule" of referenced framing standard and with AFPA's "National Design Specifications for Wood Construction."
  - 4. "Table 23-I-Q--Nailing Schedule" of the Uniform Building Code.
  - 5. "Table 2305.2--Fastening Schedule" of the BOCA National Building Code.
  - 6. "Table 1705.1--Fastening Schedule," of the Standard Building Code.
- F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- G. Use hot-dip galvanized or stainless-steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.

- H. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

### 3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- C. Install permanent grounds of dressed, preservative-treated, key-beveled lumber not less than **1-1/2 inches (38 mm)** wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.3 WOOD FRAMING, GENERAL

- A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Install framing members of size and at spacing indicated.
- D. Do not splice structural members between supports.
- E. Firestop concealed spaces of wood-framed walls and partitions at each floor level and at ceiling line of top story. Where firestopping is not inherent in framing system used, provide closely fitted wood blocks of **2-inch nominal- (38-mm actual-)** thickness lumber of same width as framing members.

### 3.5 WALL AND PARTITION FRAMING

- A. General: Arrange studs so that wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using members of **2-inch nominal (38-mm actual)** thickness whose widths equal that of studs; except single top plate may be used for non-load-bearing partitions. Nail or anchor plates to supporting construction, unless otherwise indicated.
  1. For exterior walls, provide **2-by-6-inch nominal- (38-by-140-mm actual-)** size wood studs spaced **24 inches (610 mm)** o.c., except where otherwise indicated or required.
  2. For exterior walls, provide **2-by-4-inch nominal- (38-by-89-mm actual-)** size wood studs spaced **16 inches (406 mm)** o.c., except where otherwise indicated or required.
  3. For exterior walls, provide 38-by-140-mm actual-size wood studs spaced 600 mm o.c., except where otherwise indicated or required.
  4. For exterior walls, provide 38-by-89-mm actual-size wood studs spaced 400 mm o.c., except where otherwise indicated or required.
  5. For interior partitions and walls, provide **2-by-4-inch nominal- (38-by-89-mm actual-)** size wood studs spaced **16 inches (406 mm)** o.c., except where otherwise indicated or required.
  6. For interior partitions and walls, provide 38-by-89-mm actual-size wood studs spaced 400 mm o.c., except where otherwise indicated or required.

- B. Construct corners and intersections with 3 or more studs. Provide miscellaneous blocking and framing as shown and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide continuous horizontal blocking at midheight of single-story partitions over 96 inches (2438 mm) high and multistory partitions, using members of 2-inch nominal (38-mm actual) thickness and of same width as wall or partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.
  - 1. For non-load-bearing partitions, provide double-jamb studs with headers not less than 4-inch nominal (89-mm actual) depth for openings 36 inches (900 mm) and less in width, and not less than 6-inch nominal (140-mm actual) depth for wider openings.
  - 2. For load-bearing walls, provide double-jamb studs for openings 72 inches (1800 mm) and less in width, and triple-jamb studs for wider openings. Provide headers of depth shown or, if not shown, as recommended by AFPA's "Manual for Wood Frame Construction."
- D. Provide bracing in exterior walls, at both walls of each external corner, full-story height, unless otherwise indicated. Provide one of the following:
- E. Provide bracing in walls, at locations indicated, full-story height, unless otherwise indicated. Provide one of the following:
  - 1. Diagonal bracing at 45-degree angle using let-in 1-by-4-inch nominal- (19-by-89-mm actual-) size boards.
  - 2. Diagonal bracing at 45-degree angle using metal bracing.
  - 3. Plywood panels, not less than 48 by 96 inches (1219 by 2438 mm) applied vertically.
  - 4. Performance-rated structural-use panels, not less than 48 by 96 inches (1219 by 2438 mm) applied vertically.
  - 5. Particleboard sheathing panels, not less than 48 by 96 inches (1219 by 2438 mm) applied vertically.
  - 6. In lieu of bracing at corners or at locations indicated, continuous gypsum sheathing may be provided in panels not less than 48 by 96 inches (1219 by 2438 mm) applied vertically.
  - 7. In lieu of bracing at corners or at locations indicated, continuous fiberboard sheathing, intermediate type, may be provided in panels not less than 48 by 96 inches (1219 by 2438 mm) applied vertically.

### 3.6 RAFTER AND CEILING JOIST FRAMING

- A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
  - 1. Where ceiling joists are at right angles to rafters, provide additional short joists perpendicular to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- (19-by-184-mm actual-) size or 2-by-4-inch nominal- (38-by-89-mm actual-) size stringers spaced 48 inches (1200 mm) o.c. crosswise over main ceiling joists.
- B. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

1. At valleys, provide double-valley rafters of size shown or, if not shown, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against valley rafters.
  2. At hips, provide hip rafter of size shown or, if not shown, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- C. Provide collar beams (ties) as shown or, if not shown, provide 1-by-6-inch nominal- (19-by-140-mm actual-) size boards between every third pair of rafters, but not more than 48 inches (1219 mm) o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Provide special framing as shown for eaves, overhangs, dormers, and similar conditions, if any.

### 3.8 INSTALLATION OF STRUCTURAL-USE PANELS

- A. General: Comply with applicable recommendations contained in APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
1. Comply with "Code Plus" provisions of above-referenced guide.
- B. Fastening Methods: Fasten panels as indicated below:
1. Sheathing: Nail to framing.
  2. Sheathing: Nail or staple to framing.
    - a. Space panels 1/8 inch (3 mm) at edges and ends.

END OF SECTION 06100

## SECTION 06150 - WOOD DECKING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Glued-laminated wood roof decking.

#### 1.3 SUBMITTALS

- A. Product Data: For glued-laminated wood decking. Include installation instructions and data on fabrication.
- B. Wood-Treatment Certificates: Signed by wood treater certifying that treatment processes comply with requirements.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed wood decking installation similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Schedule delivery of wood decking to avoid extended on-site storage and to avoid delaying the Work.
- B. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.

### PART 2 - PRODUCTS

#### 2.1 LUMBER, GENERAL

- A. General: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
  - 1. NELMA - Northeastern Lumber Manufacturers Association.

2. NLGA - National Lumber Grades Authority (Canada).
  3. RIS - Redwood Inspection Service.
  4. SPIB - Southern Pine Inspection Bureau.
  5. WCLIB - West Coast Lumber Inspection Bureau.
  6. WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide wood decking with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, species, grade, moisture content at time of surfacing, and mill. Apply grade stamp to surfaces that will not be exposed to view.
- D. Preservative Treatment: Where preservative treatment is indicated, pressure treat lumber with waterborne solution to comply with AWWPA C2 for aboveground use before laminating.
1. After treatment, redry wood to 15 percent maximum moisture content.
  2. Use preservative solution with water-repellent additive.
  3. Use preservative solution without water repellents or other substances that might interfere with application of indicated finishes.
  4. Do not use chemicals containing arsenic or chromium.

## 2.2 GLUED-LAMINATED WOOD DECKING

- A. Face Species: Douglas fir-larch or Douglas fir-larch (North).
- B. Face Species: Ponderosa pine.
- C. Face Species: Western cedars or western cedars (North).
- D. Face Species: Alaska cedar.
- E. Face Species: Southern pine.
- F. Face Grade: Custom.
- G. Face Grade: Decorative.
- H. Face Grade: Service.
- I. Face Surface: Smooth sanded.
- J. Face Surface: Saw textured.
- K. Face Surface: Rough sanded or wire brushed.
- L. Edge Pattern: Standard vee.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install solid wood decking to comply with referenced decking standard and with end joints located according to lay-up indicated.
- B. Install laminated wood decking to comply with manufacturer's written instructions and with end joints located according to lay-up indicated. Apply joint sealant between decking and supports and between tongues and grooves at outside wall supports.
  - 1. Nail each course of decking at each support with one nail slant nailed above the tongue and one straight nailed through the face.
    - a. Use 12d nails for 2-inch nominal (37-mm actual) decking.
    - b. Use 30d nails for 3-inch nominal (56-mm actual) decking.
    - c. Use 60d nails for 4-inch nominal (75-mm actual) decking. Predrill decking to prevent splitting.
    - d. Use 30d tongue nails in bottom tongue and 3/8-inch (10-mm) face spikes for 5-inch nominal (94-mm actual) decking. Predrill decking at spikes to prevent splitting.
  - 2. Slant nail each course to the tongue of the adjacent course at 30 inches (750 mm) o.c. and within 12 inches (300 mm) of the end of each unit. Stagger nailing in adjacent courses 15 inches (380 mm).
    - a. Use 6d nails for 2-inch nominal (37-mm actual) decking.
    - b. Use 8d nails for 3-inch nominal (56-mm actual) decking.
    - c. Use 10d nails for 4-inch nominal (75-mm actual) decking.
    - d. Use 16d nails for 5-inch nominal (94-mm actual) decking.

### 3.2 ADJUSTING AND CLEANING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged decking if repairs are not approved by Architect.

### 3.3 PROTECTION

- A. Provide temporary waterproof covering to protect exposed decking before applying roofing.

END OF SECTION 06150

## SECTION 07411 - MANUFACTURED ROOF PANELS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings

## 1.2 SUMMARY

- A. This Section includes the following:

- 1. Lap-seam roof panels.

- B. Related Sections include the following:

- 1. Division 6 Section "Rough Carpentry" for wood framing and sheathing.
  - 2. Division 7 Section "Manufactured Wall Panels" for preformed metal wall panels.
  - 3. Division 7 Section "Sheet Metal Flashing and Trim" for flashing not part of roofing and other sheet metal work.
  - 4. Division 7 Section "Joint Sealants" for field-applied sealants.

## 1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide manufactured roof panel assemblies complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water into the building interior.
- B. Water Penetration: Provide manufactured roof panel assemblies with no water penetration as defined in the test method when tested according to ASTM E 1646 at a minimum differential pressure of 20 percent of inward acting, wind-load design pressure of not less than 6.24 lb/sq. ft. (300 Pa) and not more than 12.0 lb/sq. ft. (575 Pa).
- C. Wind-Uplift Resistance: Provide roof panel assemblies that meet requirements of UL 580 for Class 90 wind-uplift resistance.

## 1.4 SUBMITTALS

- A. Product Data: Include manufacturer's product specifications, standard details, certified product test results, and general recommendations, as applicable to materials and finishes for each component and for total panel assemblies.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed metal roof panel projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver panels and other components so they will not be damaged or deformed. Package panels for protection against damage during transportation or handling.
- B. Handling: Exercise care in unloading, storing, and erecting roof panels to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight and ventilated covering. Store panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish opening dimensions and proceed with fabricating roof panels without field measurements or allow for trimming panel units. Coordinate roof construction to ensure actual locations of structural members and to ensure opening dimensions correspond to established dimensions.

## 1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Weathertight Warranty: Submit a written warranty executed by manufacturer agreeing to repair or replace metal roof panel assembly that fails to remain weathertight within the specified warranty period.
- C. Weathertight Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal panels that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide panels by one of the following:
  - 1. Steel Roof Panels:
    - a. AEP-Span.
    - b. American Buildings Roofing and Architectural Products.
    - c. Architectural Building Components.
    - d. Architectural Roofing and Siding, Inc.
    - e. Berridge Manufacturing Co.

- f. BHP Steel Building Products USA Inc.
- g. Butler Manufacturing Co.
- h. Carlisle Engineered Metals.
- i. Copper Sales, Inc.
- j. Delcoa Industries, Inc.
- k. Englert, Inc.
- l. Fabral/Gentec Building Products, Inc.
- m. Fashion, Inc.
- n. Flexospan, Inc.
- o. Innovative Metals Co., Inc.
- p. K-Metals, Inc.
- q. McElroy Metal, Inc.
- r. Merchant & Evans, Inc.
- s. Metal Building Components, Inc.
- t. Metal Sales Mfg. Corp.
- u. Modern Metal Systems, Inc.
- v. Morin Corporation.
- w. NCI Building Components.
- x. Perma-Clad Products, Inc.
- y. Petersen Aluminum Corp.
- z. Robertson: H.H. Robertson Company.
- aa. Smith Steelite, Inc.
- ab. Steelco/MCP.
- ac. Steelox Roofing Systems, Inc.
- ad. Taylor Metal Products, Inc.
- ae. VicWest Steel.
- af. Vincent Metals.

## 2.2 METALS AND FINISHES

- A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with [ASTM A 755 \(ASTM A 755M\)](#) and the following requirements:
  - 1. Galvanized Steel Sheet: [ASTM A 653, G90 \(ASTM A 653M, Z275\)](#); structural quality.

## 2.3 ROOF PANEL ASSEMBLIES

- A. Lap-Seam Roof Panels: Manufacturer's standard factory-formed, lap-seam roof panel assembly designed for mechanical attachment of panels to roof purlins or deck using exposed fasteners and sealants.

## 2.4 UNDERLAYMENT MATERIALS

- A. Felts: ASTM D 226, Type I (No. 15), asphalt-saturated organic felts.

## 2.5 MISCELLANEOUS MATERIALS

- A. General: Provide materials and accessories required for a complete roof panel assembly and as recommended by panel manufacturer, unless otherwise indicated.
- B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.

1. Use stainless-steel fasteners for exterior applications and galvanized steel fasteners for interior applications.
2. Provide exposed fasteners with heads matching color of panel by means of plastic caps or factory-applied coating.
3. Provide metal-backed neoprene washers under heads of exposed fasteners bearing on weather side of panels.
4. Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.

H. Accessories: Unless otherwise specified, provide components required for a complete roof panel assembly including trim, copings, fasciae, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.

1. Closure Strips: Closed-cell, self-extinguishing, expanded, cellular, rubber or cross-linked, polyolefin-foam flexible closure strips. Cut or premold to match configuration of panels. Provide closure strips where indicated or necessary to ensure weathertight construction.
2. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
3. Elastomeric Joint Sealant: ASTM C 920, of base polymer, type, grade, class, and use classifications required to seal joints in panel roofing and remain weathertight. Provide sealant recommended by panel manufacturer.

## 2.6 FABRICATION

A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements indicated for conditions affecting performance of metal panel roofing.
1. Panel Supports and Anchorage: Examine roof framing to verify that purlins, angles, channels, and other secondary structural panel support members and anchorage have been installed according to written instructions of panel manufacturer.
  2. Do not proceed with roof panel installation until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Coordinate metal panel roofing with rain drainage work; flashing; trim; and construction of decks, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
- B. Promptly remove protective film, if any, from exposed surfaces of metal panels. Strip with care to avoid damage to finish.

### 3.3 PANEL INSTALLATION

- A. General: Comply with panel manufacturer's written instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Field cutting exterior panels by torch is not permitted.
  - 2. Install panels with exposed exterior and interior fasteners, prefinished to match panel finishes.
  - 3. Install panels over solid substrate with minimum 3:12 (1:4) slope. Install 2 ply of felt from lower edge up, with at least 3-inch (75-mm) side laps and 4-inch (100-mm) end laps.
- B. Accessories: Install components required for a complete roof panel assembly including trim, copings, fasciae, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, gaskets, fillers, closure strips, and similar items.
- C. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating, by applying rubberized-asphalt underlayment to each metal surface, or by other permanent separation as recommended by manufacturers of dissimilar metals.
- D. Install felt underlayment and building-paper slip sheet on roof deck under metal panels, unless otherwise recommended by panel manufacturer. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under metal panels. Apply from eave to ridge in shingle fashion and lap joints a minimum of 2 inches (50 mm).
- E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not otherwise indicated, types recommended by panel manufacturer.
  - 1. Install weatherseal under high end flashing. Flash and seal panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
  - 2. Seal panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by panel manufacturer.
  - 3. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."
- F. Lap-Seam Roof Panels: Provide sealant tape at lapped joints of ribbed or fluted panels and between panels and protruding equipment, vents, and accessories.
  - 1. Apply a continuous ribbon of sealant tape to clean, dry surface of the weather side of fastenings on end laps; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weatherproof to driving rains.

### 3.4 CLEANING AND PROTECTING

- A. Damaged Units: Replace panels and other components of the Work that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- B. Cleaning: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.

END OF SECTION 07411

## SECTION 07412 - MANUFACTURED WALL PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings

#### 1.2 SUMMARY

- A. This Section includes the following:

- 1. Metal wall panels with exposed fasteners.

- B. Related Sections include the following:

- 1. Division 6 Section "Rough Carpentry" for wood framing.
- 2. Division 7 Section "Manufactured Roof Panels" for preformed metal roof panels.
- 3. Division 7 Section "Sheet Metal Flashing and Trim" for metal flashing and trim not part of this Work.
- 4. Division 7 Section "Joint Sealants" for field-applied sealants.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide manufactured wall panel capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water into the building interior.

#### 1.4 SUBMITTALS

- A. Product Data: Include manufacturer's product specifications, standard details, certified product test results, and general recommendations, as applicable to materials and finishes for each component and for total panel assemblies.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed metal wall panel projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver panels and other components so they will not be damaged or deformed. Package panels for protection against damage during transportation or handling.
- B. Handling: Exercise care in unloading, storing, and erecting wall panels to prevent bending, warping, twisting, and surface damage.

- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight and ventilated covering. Store panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish opening dimensions and proceed with fabricating wall panels without field measurements or allow for trimming panel units. Coordinate wall construction to ensure actual locations of structural members and to ensure opening dimensions correspond to established dimensions.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal panels that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide panels by one of the following:
  - 1. Galvanized Steel Corrugated Wall Panels:
    - a. Union Corrugating Company
    - b. American Buildings Roofing and Architectural Products.
    - c. Architectural Roofing and Siding, Inc.
    - d. Atas Aluminum Corp.
    - e. Berridge Manufacturing Co.
    - f. BHP Steel Building Products USA Inc.
    - g. Carlisle Engineered Metals.
    - h. Copper Sales, Inc.
    - i. Fabral/Gentec Building Products, Inc.
    - j. Flexospan, Inc.
    - k. K-Metals, Inc.
    - l. Merchant & Evans, Inc.
    - m. Metal Building Components, Inc.
    - n. Metal Sales Mfg. Corp.
    - o. Modern Metal Systems, Inc.
    - p. Morin Corporation.
    - q. NCI Building Components.
    - r. Petersen Aluminum Corp.
    - s. Reynolds Metals Company.
    - t. Robertson: H.H. Robertson Company.
    - u. Smith Steelite, Inc.
    - v. Steelco/MCP.
    - w. VicWest Steel.

## 2.2 METALS AND FINISHES

- A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with [ASTM A 755 \(ASTM A 755M\)](#) and the following requirements:
1. Galvanized Steel Sheet: [ASTM A 653, G90 \(ASTM A 653M, Z275\)](#); structural quality.

## 2.3 WALL PANEL ASSEMBLIES

- A. Exterior Wall Panels: Fabricate panel face sheets to the profile or configuration indicated; and of the material, finish, and thickness indicated. Design joints between panels to form weathertight seals.
1. Steel Face Sheet: [0.028-inch- \(0.7-mm-\)](#) thick, metallic-coated steel sheet with organic coating finish, unless otherwise indicated.

## 2.4 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.
1. Use stainless-steel fasteners for exterior applications and galvanized steel fasteners for interior applications.
  2. Provide metal-backed neoprene washers under heads of exposed fasteners located on weather side of panels.
- B. Accessories: Unless otherwise specified, provide components required for a complete wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, seam covers, flashings, louvers, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.
1. Closure Strips: Closed-cell, self-extinguishing, expanded, cellular, rubber or cross-linked, polyolefin-foam flexible closure strips. Cut or premold to match configuration of panels. Provide closure strips where indicated or necessary to ensure weathertight construction.
  2. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
  3. Joint Sealant: One-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant as recommended by panel manufacturer.

## 2.7 FABRICATION

- A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements indicated for conditions affecting performance of metal panel walls.
  - 1. Panel Supports and Anchorage: Examine wall framing to verify that girts, angles, and other secondary structural panel support members and anchorage have been installed to meet requirements of panel manufacturer.
  - 2. Do not proceed with wall panel installation until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Coordinate metal wall panels with rain drainage work; flashing; trim; and construction of soffits, roofing, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
- B. Promptly remove protective film, if any, from exposed surfaces of metal panels. Strip with care to avoid damage to finish.

### 3.3 PANEL INSTALLATION

- A. General: Comply with panel manufacturer's written instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Field cutting exterior panels by torch is not permitted.
  - 2. Install panels with exposed exterior, prefinished to match panel finishes.
  - 4. Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled, uniform compression for positive seal without rupture of neoprene washer.
- B. Accessories: Install components required for a complete wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, seam covers, flashings, louvers, sealants, gaskets, fillers, closure strips, and similar items.
- C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not otherwise indicated, types recommended by panel manufacturer.
  - 1. Install weatherseal to prevent air and moisture penetration. Flash and seal panels at ends and intersections with other materials with rubber, neoprene, or other closures to exclude weather.
  - 2. Seal panel end laps with a bead of tape or sealant, full width of panel. Seal side joints where recommended by panel manufacturer.
  - 3. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."
- D. Wall Panels: Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as necessary for waterproofing. Handle and apply sealant and back-up according to sealant manufacturer's written instructions.

1. Align bottom of wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  2. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
  3. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- E. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating or by other permanent separation as recommended by manufacturers of dissimilar metals.
- F. Coat back side of metal panels with bituminous coating where it will contact wood, ferrous metal, or cementitious construction.
- G. Installation Tolerances: Shim and align panel units within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)** on level, plumb, and location lines as indicated and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

#### 3.4 CLEANING AND PROTECTING

- A. Damaged Units: Replace panels and other components of the Work that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- B. Cleaning: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.

END OF SECTION 07412

## SECTION 07920 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings.

#### 1.2 SUMMARY

- A. This Section includes sealants for the following applications, including those specified by reference to this Section:
- B. This Section includes sealants for the following applications:
  - 1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
    - a. Perimeter joints around frames of doors.
- C. Related Sections include the following:
  - 1. Division 8 Section "Steel Doors and Frames" for glazing sealants.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

#### 1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS AND MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in the sealant schedules at the end of Part 3.

### 2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

### 2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

### 2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
    - a. Metal.
- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealants by proven techniques to comply with the following:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses provided for each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

### 3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as follows:

1. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements.

### 3.5 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

### 3.7 ELASTOMERIC JOINT-SEALANT SCHEDULE

- A. Medium-Modulus Neutral-Curing Silicone Sealant [ES-#]: Where joint sealants of this type are indicated, provide products complying with the following:

1. Products: **Provide one of the following:**

- a. 791; Dow Corning.
- b. CWS; Dow Corning.
- c. HiFlex 393; NUCO Industries, Inc.
- d. PSI-631; Polymeric Systems, Inc.
- e. SM5731 Poly-Glaze; Schnee-Morehead, Inc.
- f. SM5733 Poly-Glaze; Schnee-Morehead, Inc.
- g. Spectrem 2; Tremco.
- h. Tremsil 600; Tremco.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

- a. Use O Joint Substrates: [**wood.**]

6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.
7. Applications: Joints around door frames and exterior panel joints.

END OF SECTION 07920

## SECTION 08110 - STEEL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings

#### 1.2 SUMMARY

- A. This Section includes steel doors and frames.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 8 Section "Custom Steel Doors and Frames" for doors manufactured according to the Hollow Metal Manufacturers Association's standards.
  - 2. Division 8 Section "Door Hardware" for door hardware and weatherstripping.
  - 3. Division 9 Section "Painting" for field painting primed doors and frames.

#### 1.3 SUBMITTALS

- A. Product Data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.
- B. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
- C. Samples for initial selection in the form of manufacturer's color charts showing the full range of colors available for factory-finished doors and frames.

#### 1.4 QUALITY ASSURANCE

- A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch- (100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to promote air circulation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Steel Doors and Frames:
    - a. Amweld Building Products, Inc.
    - b. Benchmark Commercial Doors.
    - c. Ceco Door Products.
    - d. Copco Door Co.
    - e. Curries Co.
    - f. Deansteel Manufacturing Co.
    - g. Fenestra Corp.
    - h. Kewanee Corp.
    - i. Mesker Door, Inc.
    - j. Pioneer Industries.
    - k. Republic Builders Products.
    - l. Steelcraft.

### 2.2 MATERIALS

- A. Cold-Rolled Steel Sheets: Carbon steel complying with [ASTM A 366 \(ASTM A 366M\)](#), commercial quality, or [ASTM A 620 \(ASTM A 620M\)](#), drawing quality, special killed.
- B. Galvanized Steel Sheets: Zinc-coated carbon steel complying with [ASTM A 526 \(ASTM A 526M\)](#), commercial quality, or [ASTM A 642 \(ASTM A 642M\)](#), drawing quality, hot-dip galvanized according to [ASTM A 525, with A 60 or G 60 \(ASTM A 525M, with Z 180 or ZF 180\)](#) coating designation, mill phosphatized.
- C. Supports and Anchors: Fabricated from not less than [0.0478-inch- \(1.2-mm-\)](#) thick steel sheet; [0.0516-inch- \(1.3-mm-\)](#) thick galvanized steel where used with galvanized steel frames.
- D. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A 153, Class C or D as applicable.

### 2.3 DOORS

- A. Steel Doors: Provide [1-3/4-inch- \(44-mm-\)](#) thick doors of materials and ANSI/SDI 100 grades and models specified below, or as indicated on Drawings or schedules:
  - 1. Exterior Doors: Grade II, heavy-duty, Model 1, full flush design, minimum [0.0516-inch- \(1.3-mm-\)](#) thick galvanized steel sheet faces.

### 2.4 FRAMES

- A. Provide metal frames for doors, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum [0.0478-inch- \(1.2-mm-\)](#) thick cold-rolled steel sheet.

1. Fabricate frames with mitered or coped and continuously welded corners.
2. Fabricate exterior frames for openings over 48 inches (1220 mm) wide from 0.0635-inch- (1.6-mm-) thick galvanized steel sheet.
3. Form exterior frames from 0.0635-inch- (1.6-mm-) thick galvanized steel sheet.

## 2.5 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.
  1. Internal Construction: One of the following manufacturer's standard core materials according to SDI standards:
    - a. Resin-impregnated paper honeycomb.
    - b. Rigid polyurethane conforming to ASTM C 591.
    - c. Rigid polystyrene conforming to ASTM C 578.
    - d. Unitized steel grid.
    - e. Vertical steel stiffeners.
    - f. Rigid mineral fiber with internal sound deadener on inside of face sheets.
  2. Clearances: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between non-fire-rated pairs of doors. Not more than 3/4 inch (19 mm) at bottom.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel sheet.
- C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- E. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- F. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI 107 and ANSI A115 Series specifications for door and frame preparation for hardware.
- G. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

## 2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for steel sheet finishes.
- C. Apply primers and organic finishes to doors and frames after fabrication.

## 2.7 STEEL SHEET FINISHES

- A. Surface Preparation: Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).
- B. Pretreatment: Immediately after surface preparation, apply a conversion coating of type suited to organic coating applied over it.
- C. Factory Priming for Field-Painted Finish: Apply shop primer that complies with ANSI A224.1 acceptance criteria, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.
- D. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat that complies with ANSI A250.3. Comply with paint manufacturer's instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.0508 mm).
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
- C. Door Installation: Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100.

### 3.2 ADJUSTING AND CLEANING

- A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

## SECTION 08710 - DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings.

#### 1.2 SUMMARY

- A. This Section includes items known commercially as finish or door hardware that are required for swing doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. This Section includes the following:
  - 1. Hinges.
  - 2. Lock and latch sets.
  - 3. Bolts.
  - 4. Weatherstripping for exterior doors.
  - 5. Astragals or meeting seals on pairs of doors.
  - 6. Thresholds.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 8 Section "Standard Steel Doors and Frames" for silencers integral with hollow metal frames.

#### 1.3 SUBMITTALS

- A. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

#### 1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

#### 1.6 PRODUCT HANDLING

- A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

- B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

## 1.7 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Butts and Hinges:
    - a. Bommer Industries, Inc.
    - b. Cal-Royal Products, Inc.
    - c. Hager Hinge Co.
    - d. Lawrence Brothers, Inc.
    - e. McKinney Products Co.
    - f. H. Soss & Company.
    - g. Stanley Hardware, Div. Stanley Works.
  - 2. Cylinders and Locks:
    - a. Arrow Lock Manufacturing Co.
    - b. Best Lock Corp.
    - c. Corbin & Russwin Architectural Hardware, Div. Black & Decker Corp.
    - d. Falcon Lock Co.
    - e. Sargent Manufacturing Company.
    - f. Schlage Lock, Div. Ingersoll-Rand Door Hardware Group.
    - g. Yale Security Inc.
  - 3. Bolts:
    - a. Builders Brass Works Corp.
    - b. Glynn-Johnson Corp.
    - c. Hager Hinge Co.
    - d. H. B. Ives, A Harrow Company.
    - e. Quality Hardware Mfg. Co., Inc.; Div. Newman Tonks, Inc.
    - f. Stanley Hardware, Div. Stanley Works.

4. Thresholds:
  - a. Hager Hinge Co.
  - b. National Guard Products, Inc.
  - c. Pemko Manufacturing Co., Inc.
  - d. Reese Enterprises, Inc.
  - e. Sealeze Corp.
  - f. Zero International, Inc.

5. Astragals:
  - a. Hager Hinge Co.
  - b. National Guard Products, Inc.
  - c. Pemko Manufacturing Co., Inc.
  - d. Reese Enterprises, Inc.
  - e. Zero International, Inc.

## 2.2 SCHEDULED HARDWARE

- A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:
  1. Manufacturer's Product Designations: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article "Manufacturers" in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.
  2. ANSI/BHMA designations used elsewhere in this Section or in schedules to describe hardware items or to define quality or function are derived from the following standards. Provide products complying with these standards and requirements specified elsewhere in this Section.
    - a. Butts and Hinges: ANSI/BHMA A156.1.
    - b. Bored and Preassembled Locks and Latches: ANSI/BHMA A156.2.
    - c. Exit Devices: ANSI/BHMA A156.3.
    - d. Door Controls - Closers: ANSI/BHMA A156.4.
    - e. Auxiliary Locks and Associated Products: ANSI/BHMA A156.5.
    - f. Architectural Door Trim: ANSI/BHMA A156.6.
    - g. Template Hinge Dimensions: ANSI/BHMA A156.7.
    - h. Door Controls - Overhead Holders: ANSI/BHMA A156.8.
    - i. Interconnected Locks and Latches: ANSI/BHMA A156.12.
    - j. Mortise Locks and Latches: ANSI/BHMA A156.13.
    - k. Sliding and Folding Door Hardware: ANSI/BHMA A156.14.
    - l. Closer Holder Release Devices: ANSI/BHMA A156.15.
    - m. Auxiliary Hardware: ANSI/BHMA A156.16.
    - n. Self-Closing Hinges and Pivots: ANSI/BHMA A156.17.
    - o. Materials and Finishes: ANSI/BHMA A156.18.

### 2.3 MATERIALS AND FABRICATION

- A. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.
  - 1. Manufacturer's identification will be permitted on rim of lock cylinders only.
- B. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.
- C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.
- D. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
- E. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely.

### 2.4 HINGES, BUTTS, AND PIVOTS

- A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- B. Screws: Provide Phillips flat-head screws complying with the following requirements:
  - 1. For metal doors and frames install machine screws into drilled and tapped holes.
  - 2. For wood doors and frames install wood screws.
  - 3. For fire-rated wood doors install #12 x 1-1/4-inch (32-mm), threaded-to-the-head steel wood screws.
  - 4. Finish screw heads to match surface of hinges or pivots.
- C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
  - 1. Out-Swing Exterior Doors: Nonremovable pins.
  - 2. Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.
- D. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges per door leaf for doors 90 inches (2250 mm) or less in height and one additional hinge for each 30 inches (750 mm) of additional height.

### 2.5 LOCK CYLINDERS AND KEYING

- A. Standard System: Except as otherwise indicated, provide new masterkey system for Project.
- B. Equip locks with manufacturer's standard 6-pin tumbler cylinders.

- C. Equip locks with cylinders for interchangeable-core pin tumbler inserts. Furnish only temporary inserts for the construction period, and remove these when directed.
- D. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.
- E. Comply with Owner's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.
- F. Key Material: Provide keys of nickel silver only.
- G. Key Quantity: Furnish 3 change keys for each lock,
  - 1. Deliver keys to Owner.

## 2.6 LOCKS, LATCHES, AND BOLTS

- A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.
  - 1. Provide flat lip strikes for locks with 3-piece, antifriction latchbolts as recommended by manufacturer.
- B. Lock Throw: Provide **5/8-inch (16-mm)** minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
  - 1. Provide **1/2-inch (13-mm)** minimum throw of latch for other bored and preassembled types of locks and **3/4-inch (19-mm)** minimum throw of latch for mortise locks. Provide **1-inch (25-mm)** minimum throw for all dead bolts.
- C. Flush Bolt Heads: Minimum of **1/2-inch- (13-mm-)** diameter rods of brass, bronze, or stainless steel with minimum **12-inch- (300-mm-)** long rod for doors up to **84 inches (2100 mm)** in height. Provide longer rods as necessary for doors exceeding **84 inches (2100 mm)** in height.

## 2.7 WEATHERSTRIPPING AND SEALS

- A. General: Provide continuous weatherstripping on exterior doors. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
- B. Weatherstripping at Jambs and Heads: Provide bumper-type resilient insert and metal retainer strips, surface applied unless shown as mortised or semimortised, and of following metal, finish, and resilient bumper material:
  - 1. Extruded aluminum with natural anodized finish, **0.062-inch (1.6-mm)** minimum thickness of main walls and flanges.
  - 2. Extruded aluminum with color anodized finish as selected from manufacturer's standard color range, **0.062-inch (1.6-mm)** minimum thickness of main walls and flanges.
  - 3. Extruded bronze (brass), finish to match frame, **0.050-inch (1.3-mm)** minimum thickness of main walls and flanges.
  - 4. Spongy neoprene conforming to MIL R 6130, Class II (Closed Cell).
    - a. Grade A: **30 to 150 deg F (-1 to 65 deg C)**, oil-resistant and self-extinguishing.

- b. Grade B: 30 to 150 deg F (-1 to 65 deg C), non-oil-resistant.
    - c. Grade C: 67 to 170 deg F (19 to 77 deg C), low temperature.
  - 5. Expanded neoprene: Cellular rubber conforming to ASTM D 1056 Type 2 (closed-cell); Class B (low-swell, oil-resistant); Grade 2 (compression-deflection of 5 - 9 psi (35 - 60 kPa)); and self-extinguishing in following size:
    - a. 3/16 x 5/8 inch (5 x 16 mm).
    - b. 1/4 x 3/4 inch (6 x 19 mm).
    - c. 3/8 x 1-1/4 inches (10 x 32 mm).
  - 6. Solid neoprene conforming to MIL R 6855, Class II, Grade 40.
    - a. Flexible, hollow bulb or loop insert.
  - 7. Flexible vinyl hollow bulb or loop insert.
  - 8. Brush pile insert of polypropylene or nylon woven pile and aluminum strip backing complying with AAMA 701.2.
- D. Weatherstripping at Door Bottoms: Provide threshold consisting of contact-type resilient insert and metal housing of design and size shown and of following metal, finish, and resilient seal strip:
- 1. Extruded aluminum with natural anodized finish, 0.062-inch (1.6-mm) minimum thickness of main walls and flanges.
  - 2. Extruded aluminum with color anodized finish as selected from manufacturer's standard color range, 0.062-inch (1.6-mm) minimum thickness of main walls and flanges.
  - 3. Extruded bronze (brass) finished to match doors, 0.050-inch (1.3-mm) minimum thickness of main walls and flanges.
  - 4. Solid neoprene wiper or sweep seal complying with MIL R 6855, Class II, Grade 40.
  - 5. Flexible vinyl wiper or sweep seal strip.
  - 6. Brush pile insert of polypropylene or nylon woven pile and aluminum strip backing complying with AAMA 701.2.

## 2.14 THRESHOLDS

- A. General: Except as otherwise indicated, provide standard metal threshold unit of type, size, and profile as shown or scheduled.
- B. Exterior Hinged or Pivoted Doors: Provide units not less than 4 inches (100 mm) wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames, and as follows:
  - 1. For in-swinging doors provide units with interlocking lip and interior drain channel; include hook on bottom edge of door and drain pan.
  - 2. For out-swinging doors provide units with interlocking lip and with hook on bottom edge of door to act as weather bar.
  - 3. For out-swinging doors provide rabbeted type units with replaceable weatherstrip insert in stop.

## 2.15 HARDWARE FINISHES

- A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets (or push-pull units if no latch or lock sets).

- B. Provide finishes that match those established by BHMA or, if none established, match the Architect's sample.
- C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer."
- E. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.
- F. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.
  - 1. Rust-Resistant Finish: For iron and steel base metal required for exterior work and in areas shown as "High Humidity" areas (and also when designed with the suffix -RR), provide 0.2-mil- (0.005-mm-) thick copper coating on base metal before applying brass, bronze, nickel, or chromium plated finishes.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
  - 1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.
- C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.
- F. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

### 3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

### 3.3 HARDWARE SCHEDULE

- A. General: Provide hardware for each door to comply with requirements of Section "Door Hardware," hardware set numbers indicated in door schedule, and in the following schedule of hardware sets.
  - 1. Hardware sets indicate quantity, item, ANSI designation, size, and finish or color, as applicable.
- B. Hardware Set No. [1]: (For each door <INSERT DOOR NUMBERS FROM DOOR SCHEDULE>).
  - 1. [6] pair Butts: AB700, 4-1/2" x 4 by Hager Fin. 26D
  - 2. [1] Storeroom Lock: D80RD RHO by Schlage Fin. 626
  - 3. [1] Dust Proof Strike: DP2 by Schlage Fin 626
  - 4. [1] set Weatherstripping: 17' Length of Weather Stripping 725S by Hager
  - 5. [2] Sill Sweep: 751S-V by Hager Fin. A
  - 6. [#] Threshold: 171A X MS&A by Pemko Fin. AL

END OF SECTION 08710

## SECTION 09900 - PAINTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings.

#### 1.2 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
  - 1. Exposed exterior items and surfaces.
  - 2. Exposed interior items and surfaces.
  - 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
  - 1. Prefinished items include the following factory-finished components.
  - 2. Finished metal surfaces include the following:
    - a. Anodized aluminum.
    - b. Stainless steel.
    - c. Chromium plate.
    - d. Copper.
    - e. Bronze and brass.
  - 3. Operating parts include moving parts of operating equipment and the following:
    - a. Door hardware.
  - 5. Labels: Do not paint over code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections include the following:
  - 1. Division 2 Section "Hot-Mix Asphalt Paving" for traffic-marking paint.
  - 2. Division 2 Section "Portland Cement Concrete Paving" for traffic-marking paint.
  - 3. Division 5 Section "Structural Steel" for shop priming structural steel.
  - 4. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
  - 8.

### 1.3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
  - 1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.

### 1.4 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
  - 1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  - 2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
  - 3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.
  - 1. After color selection, the Architect will furnish color chips for surfaces to be coated.
- C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
  - 1. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
  - 3. Submit Samples on the following substrates for the Architect's review of color and texture only:
    - a. Painted Wood: Provide two 12-inch- (300-mm-) square samples of each color and material on hardboard.
    - b. Ferrous Metal: Provide two 4-inch- (100-mm-) square samples of flat metal and two 8-inch- (200-mm-) long samples of solid metal for each color and finish.

### 1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
  - 1. Product name or title of material.
  - 2. Product description (generic classification or binder type).
  - 3. Manufacturer's stock number and date of manufacture.
  - 4. Contents by volume, for pigment and vehicle constituents.

5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

## 1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

## 1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.

B. Products: Subject to compliance with requirements, provide one of the products in the paint schedules.

C. Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:

1. Devoe & Raynolds Co. (Devoe).
2. Fuller-O'Brien Paints (Fuller).

3. Glidden Co. (The) (Glidden).
4. Benjamin Moore & Co. (Moore).
5. PPG Industries, Inc. (PPG).
6. Pratt & Lambert, Inc. (P & L).
7. Sherwin-Williams Co. (S-W).

## 2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
  1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Provide color selections made by the Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
  1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
  2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

### 3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
  1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

- B. **Cleaning:** Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. **Surface Preparation:** Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime.
  2. **Wood:** Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
    - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
    - c. When transparent finish is required, backprime with spar varnish.
    - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
    - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
  3. **Ferrous Metals:** Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
    - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
    - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
- D. **Materials Preparation:** Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
  3. Use only thinners approved by paint manufacturer and only within recommended limits.

### 3.3 APPLICATION

- A. **General:** Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the schedules.
  2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

F. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

### 3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

### 3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
  1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### 3.7 EXTERIOR – INTERIOR PAINT SCHEDULE

- A. Smooth Wood: Provide the following finish systems over smooth wood siding and other smooth, exterior wood surfaces:
  1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.
    - a. Primer: Exterior, alkyd or latex, wood primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).

1) Devoe:	1102 All-Weather Exterior Alkyd House Paint Primer.
2) Fuller:	220-08 Exterior Latex Wood Primer.
3) Glidden:	UH 450 Ultra-Hide Oil/Alkyd Exterior Primer.
4) Moore:	Moorwhite Primer #100.
5) PPG:	72-1 Sun-Proof Exterior House & Trim Wood Primer Flat--Latex.
6) P & L:	S/D 1002 Suprime "2" Exterior Latex Wood Primer.
    - b. First and Second Coats: Semigloss, waterborne, exterior, acrylic enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils (0.061 mm).

1) Devoe:	17XX Wonder-Shield Semi-Gloss Exterior Acrylic Latex House and Trim Paint.
2) Fuller:	664-XX Weather King II Semi-Gloss House & Trim Paint.
3) Glidden:	6600 Series Spred Ultra Exterior Gloss Latex House & Trim Paint.
4) Moore:	MoorGlo Latex House & Trim Paint #096.
5) PPG:	78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.
6) P & L:	Z/F 3100 Series Aqua Royal Latex House & Trim Finish.
- F. Wood Trim: Provide the following finish systems over exterior wood trim:
  1. Medium-Shade, Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.

- a. Primer: Exterior, acrylic-latex primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils (0.036 mm).
  - 1) Devoe: 1102 All-Weather Exterior Alkyd House Paint Primer.
  - 2) Fuller: 220-08 Exterior Latex Wood Primer.
  - 3) Glidden: UH 790 Ultra-Hide Exterior Latex Prime Coat.
  - 4) Moore: Moorwhite Primer #100.
  - 5) PPG: 72-1 Sun-Proof Exterior House & Trim Wood Primer Flat--Latex.
  - 6) P & L: S/D 1002 Suprime "2" Exterior Latex Wood Primer.
  
- b. First and Second Coats: Semigloss, waterborne, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils (0.061 mm).
  - 1) Devoe: 17XX Wonder-Shield Semi-Gloss Exterior Acrylic Latex House and Trim Paint.
  - 2) Fuller: 664-XX Weather King II Semi-Gloss House & Trim Paint.
  - 3) Glidden: 6600 Series Spred Ultra Exterior Gloss Latex House & Trim Paint.
  - 4) Moore: MoorGlo Latex House & Trim Paint #096.
  - 5) PPG: 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.
  - 6) P & L: Z/F 3100 Series Aqua Royal Latex House & Trim Finish.

G. Rough Siding: Provide the following finish systems over exterior wood shakes and rough wood siding:

1. Flat Acrylic Finish: 2 coats of an acrylic-latex stain.

- a. First and Second Coats: Solid-color, exterior, acrylic-latex, wood stain applied at spreading rate recommended by the manufacturer.
  - 1) Devoe: 93XX All-Weather Acrylic Latex Color Stain.
  - 2) Fuller: 667-XX Ful-Stain Solid-Cote Latex Low VOC Compliant Flat Stain.
  - 3) Glidden: 9400 Series Endurance Water-Repellent Long-Life Solid Color Oil/Acrylic Stain.
  - 4) Moore: Moorwood Vinyl Acrylic Latex Stain #89.
  - 5) PPG: 77-400 Series Pittsburgh Paints Exterior Solid Color Acrylic Latex Stains.
  - 6) P & L: Z/F 1300 Series STAINShield Solid Hide Latex Rustic Stain--100 Percent Acrylic.
  - 7) S-W: Exterior Latex Solid Color Stain B-22 Series.

H. Plywood: Provide the following finish systems over exterior plywood:

1. Low-Luster Finish: 2 finish coats over a primer.

- a. Primer: Exterior, acrylic-latex, wood primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).

- 1) Devoe: 1502 Wonder-Shield Exterior Acrylic Latex House Paint Primer.
- 2) Fuller: 220-08 Exterior Latex Wood Primer.
- 3) Glidden: UH 790 Ultra-Hide Exterior Latex Prime Coat.
- 4) Moore: Moorwhite Primer #100.
- 5) PPG: 72-1 Sun-Proof Exterior House & Trim Wood Primer Flat--Latex.
- 6) P & L: S/D 1002 Suprime "2" Exterior Latex Wood Primer.

b. First and Second Coats: Low-sheen (eggshell or satin), exterior, acrylic-emulsion paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).

- 1) Devoe: 16XX Wonder-Shield Exterior Acrylic Latex Satin House and Trim Paint.
- 2) Fuller: 261-XX Eggshell Sheen Latex House and Trim Paint.
- 3) Glidden: 6700 Series Spred Ultra Exterior Satin Latex House and Trim Paint.
- 4) Moore: MoorGard Latex House Paint #103.
- 5) PPG: 76 Line Sun-Proof Exterior House & Trim Acrylic Satin Latex.
- 6) P & L: Z/F 1800 Series Aqua Shell Exterior Latex Eggshell Paint.

I. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a rust-inhibitive primer.

a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).

- 1) Devoe: 13101 Mirrolac Rust Penetrating Metal Primer.
- 2) Fuller: 621-04 Blox-Rust Alkyd Metal Primer.
- 3) Glidden: 5205 Glid-Guard Tank & Structural Primer, Red.
- 4) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
- 5) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
- 6) P & L: S/D 1009 Suprime "9" Interior/Exterior Alkyd Metal Primer.

b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).

- 1) Devoe: 17XX Wonder-Shield Semi-Gloss Exterior Acrylic Latex House and Trim Paint.
- 2) Fuller: 664-XX Weather King II Semi-Gloss House & Trim Paint.
- 3) Glidden: 6600 Series Spred Ultra Exterior Gloss Latex House & Trim Paint.
- 4) Moore: MoorGlo Latex House & Trim Paint #096.
- 5) PPG: 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.

6) P & L:

Z/F 3100 Series Aqua Royal Latex House & Trim  
Finish.

END OF SECTION 09900